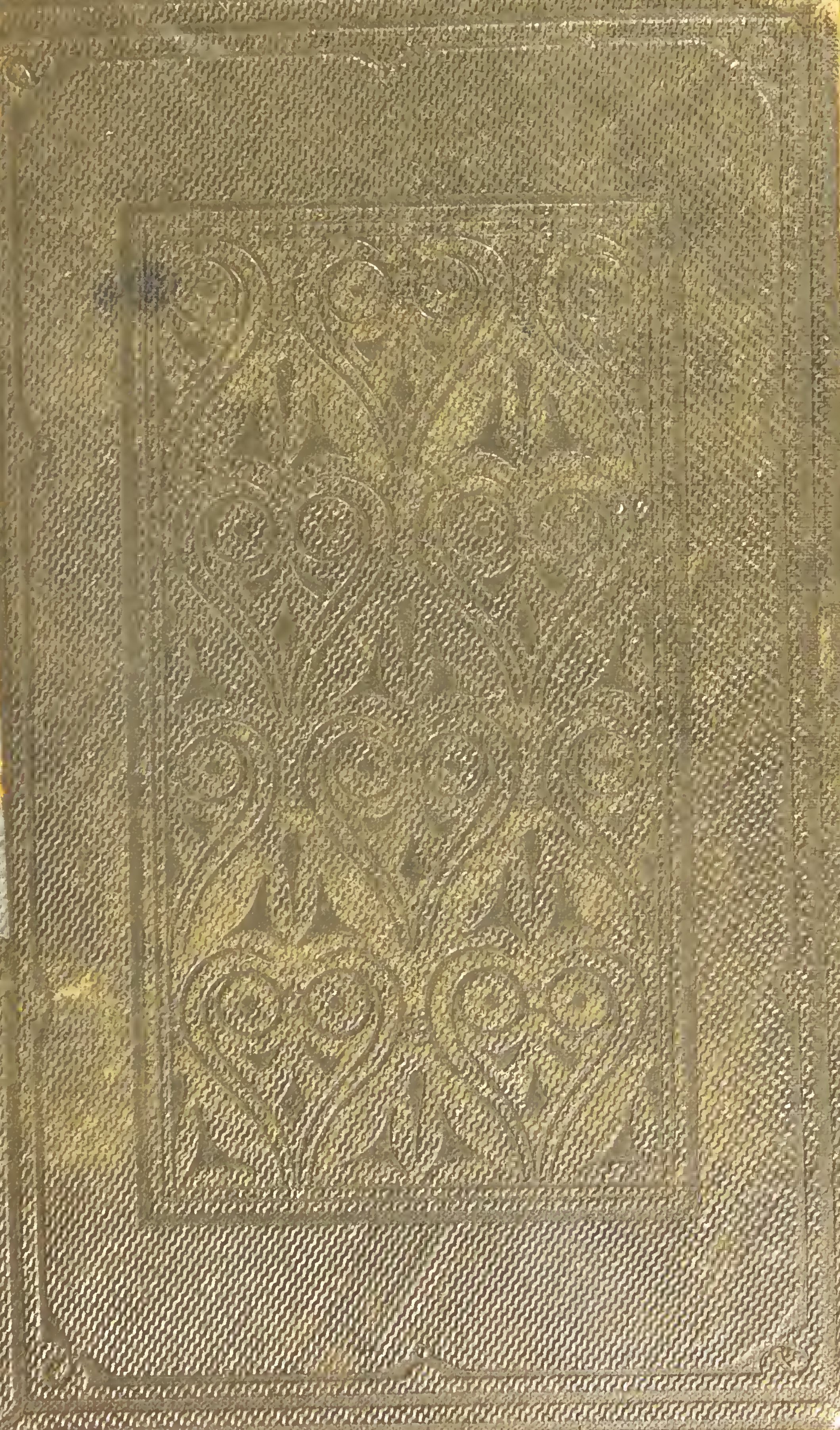


Bf 4.20

R40053

Digitized by the Internet Archive
in 2015

https://archive.org/details/b21941439

GOUT,

AND RHEUMATIC GOUT.

THE
NATURE AND TREATMENT OF
GOUT
AND
RHEUMATIC GOUT.

BY

ALFRED BARING GARROD, M.D., F.R.S.,

Fellow of the Royal College of Physicians; Physician to University College
Hospital; Professor of Materia Medica, Therapeutics, and
Clinical Medicine at University College.

> "Observez la nature, et suivez
> la route qu'elle vous trace."
> J. J. Rousseau.

LONDON:
WALTON AND MABERLY,
UPPER GOWER STREET, AND IVY LANE, PATERNOSTER ROW.
MDCCCLIX.

LONDON:
BRADBURY AND EVANS, PRINTERS, WHITEFRIARS.

TO

THOMAS WATSON, M.D., F.R.S.,

PHYSICIAN EXTRAORDINARY TO THE QUEEN.

◆

DEAR DR. WATSON,

IT is with pleasure I avail myself of the present opportunity of expressing my appreciation of the great benefits you have conferred on the medical profession by your valuable example, and your admirable and instructive writings,—furthermore, of much personal kindness received at your hands. I confess that I should have been better pleased had I produced a work more worthy of such a dedication; but, although most imperfect, I trust you will receive it as the result of a patient investigation into the nature of a disease, which, from the many eminent characters who have been its martyrs, must naturally be of considerable interest to mankind.

I am, Dear Dr. Watson,
Yours very faithfully,
A. B. GARROD.

November, 1859.

PREFACE.

As the English press already teems with works on Gout, it may be expected that an author about to add to their number, should give some explanation of his reasons for so doing.

Having carried on a series of investigations on Gout and Rheumatism for the last twelve years, some of the results of which have been already made known in the Medico-Chirurgical Transactions, I have been induced to frame the present volume, with the view of embodying my experience in a more extended and connected form.

The large field open to me as physician to a London hospital, has afforded opportunities of investigating many of the important phenomena of gout more minutely than could have been effected had the inquiries been confined to cases in private practice; and I am sanguine enough to hope that the investigations will prove useful in throwing some light on its pathology, and lead to a more rational and successful mode of treatment.

The portions of the work in which the results of my own labours are more particularly contained, are the chapters devoted to the condition of the blood and the characters of the urine; also those occupied with the morbid anatomy and intimate nature of the disease. The influence of lead as a predisposing cause will be found dwelt upon at some length, as likewise the treatment of the chronic forms of the disorder.

In conclusion, I would wish to express my thanks to the Council of University College for the opportunities afforded me of making use of preparations in their Anatomical Museum for some of the illustrations contained in the Work.

84, Harley Street, Cavendish Square,
November, 1859.

CONTENTS.

CHAPTER I.

PAGE

Introductory Remarks :—Knowledge of the ancient writers upon the subject of Gout—Views of Hippocrates—Celsus—Galen—Aretæus—Cælius Aurelianus—Alexander Trallianus—Aëtius—Paulus Ægineta—Demetrius Pepagomenos—The Arabian Physicians—The principal Authors of the 17th and 18th centuries—Extracts from Lucian's Poems—The Tragapodagra and Ocypus—Classification of Gout adopted by different Authors—Dr. Cullen—Dr. Mason Good—Author's Division 1

CHAPTER II.

Acute Gout :—Description of an early Attack—Premonitory Symptoms—Seat and Character of Gouty Inflammation—Part first affected—Pain—Edema—Desquamation—Not followed by Suppuration—Apparent exceptions—Febrile Disturbance—Progress of Gout—Less common forms—Acute general Gout—Sequelæ of Acute Gout—Heberden's opinion of the desirability of the occurrence of Gout—Sydenham's description of Acute Gout 30

CHAPTER III.

Chronic Gout :—Not a constant sequel to the Acute affection—Description of—Constitutional Symptoms—Alterations of structure produced by Chronic Gout—Nature of the so-called Chalk-stones or Tophaceous deposits—Their microscopic and chemical characters—Their frequent occurrence—Situation of—Upon ears—Often useful in diagnosis—Around joints—Within bursæ—causing much deformity—Illustrative cases—Gouty Abscesses—Mr. Moore's and Mr. Howship's description of—Circumstances leading to the formation of extensive Chalk-like deposits—Sydenham's description of Chronic Gout 65

CHAPTER IV.

PAGE

Blood in Gout:—Altered condition of the Blood in Gout often assumed by the older Writers, not proved until very recently—Composition of the Blood in Health—Its alteration in Gout—Globules—Fibrin—Albumen—Discovery of Urate of Soda in the Blood—Mode of separating Uric Acid and Urate of Soda from it—Clinical Method for determining the presence of Uric Acid in the Blood—Details and Precautions—Delicacy of the Test—Ready Decomposition of Uric Acid in the Blood—Probable Changes which ensue—Table containing a short Summary of Cases of Gout in which Uric Acid was proved to exist in the Blood—Discovery of Uric Acid in Fluids artificially effused—Use in Diagnosis—Small amount of Urea in the Blood in Gout, also of Oxalic Acid—Traces of Uric Acid and Urea in healthy Blood—Perspiration in Gout—Oxalic Acid found in this Secretion 100

CHAPTER V.

Urine in Gout:—Characters of healthy Urine—Table exhibiting the Composition of Urine and the daily Elimination of its different Constituents—Uric Acid—The manner in which it exists in the Urine—Relation between the Acidity of Urine and the Uric Acid contained in it—Condition of the Urine in Acute Gout—No excessive Excretion of Uric Acid in many cases—Elimination of the Urea but little influenced—Urine in Chronic Gout—Deficient Excretion of Uric Acid—No marked Deficiency in the Excreted Urea—Frequent Presence of small amounts of Albumen—Urine of Gouty Individuals in the intervals of the Fits—Probable Explanation of the frequent Returns of Gout—Microscopic Characters of the Urine in different Forms of Gout 146

CHAPTER VI.

The Morbid Anatomy of Gout:—Great Importance of the Subject—Changes in the Joints observed by Morgagni, Dr. Monro, and others—Sir B. Brodie's Dissection of a Gouty Subject—Cruveilhier's Observations—The Author's Investigations—1. Of Cases of Chronic Gout with extensive Chalk Stones—2. Of subjects exhibiting Points of Deposition on the Ears alone—3. Where no Deposit or Deformity existed—4. When only the Ball of one Great Toe had been affected with Gout 185

CHAPTER VII.

PAGE

Morbid Anatomy of Gout continued:—Deductions drawn from the Cases related in the last Chapter—Proofs of the invariable Deposition of Chalky Matter in the Inflammation of True Gout —Microscopic and Chemical Characters of Gouty Deposits in different Structures—In Articular Cartilage—Synovial Membrane—Fibrous Tissue—Changes in the Kidneys of Gouty Subjects: 1. In the Chronic Forms of the Malady; 2. In the Early Stages—Deposits in other Situations—Often unconnected with the Disease 221

CHAPTER VIII.

Causes of Gout:—Predisposing Causes: Hereditary Influence—Sex —Age—Temperament or Constitutional Peculiarity—Alcoholic Liquors—Differences in their Power of Inducing Gout—Indigestion—Animal Diet—Absence of Exercise—Severe Study—Mental Anxiety—Climate—Lead as a Predisposing Cause of Gout—Great Frequency of the Disease among Painters and Plumbers—Influence of the Absorption of Lead upon the Excretion of Uric Acid—Exciting Causes: Wines, &c.—Dyspepsia—Cold and Moisture—Mental and Bodily Excitement or Fatigue . 249

CHAPTER IX.

Pathology or Nature of Gout:—Evidence of a close Relation between Gout and Uric Acid—Characters and Composition of Uric Acid and its Salts—Products of its Metamorphosis under different Circumstances—Its Occurrence in different Classes of Animals—Its Physiological and Pathological Relations—Opinions of the Ancients on the Nature of Gout—Cullen's Objections to the Doctrine of the Humoral Pathologists, and his own Views on the Subject—Murray Forbes' Theory—Opinions of Sir C. Scudamore, Dr. Barlow, Dr. Gairdner, and others—Reflections of Sir H. Holland—Author's own Views on the Nature of Gout —Explanation of the Gouty Diathesis and Premonitory Symptoms—Explanation of the Paroxysm and various Phenomena connected with the Disease 304

CHAPTER X.

Treatment of Gout:—Short Review of the Treatment adopted by the Ancients—Is Gout a Curable Disease?—Cullen's Opinion —Author's Views on the value of Remedies in the different

PAGE

Stages of Gout—Treatment of Acute Gout—Diet and Regimen—The Value of Purgatives—Mercurials—Their injurious Effects in many Cases—Diuretics and Diaphoretics—Blood-Letting—Colchicum—Local Treatment—Leeches—Blisters—Warm Applications—Evaporating Lotions—Anodynes—Summary of the Treatment of the Gouty Paroxysm. 359

CHAPTER XI.

Treatment of Gout:—Colchicum—Importance of the Study of its Mode of Operation—The Hermodactylus of the Ancients probably a Species of Colchicum—Chemical Composition of Colchicum—Its Physiological Action—Curative Effects not Explainable by its Purgative Property—Its Influence on the Circulating System—On the Urine—Dr. Christison's Experiments—Observations of Professor Chelius—Author's Analyses exhibiting the Effect of Colchicum on the Urine—Deductions therefrom—Mode of employing Colchicum in the Treatment of Gout—The Question discussed as to its Liability to cause Mischief—Different Preparations of Colchicum—White Hellebore in Gout—Observations on its Action 386

CHAPTER XII.

Treatment of Gout:—Its Importance in the Chronic Stages of the Disorder—Medicinal Treatment of Chronic Gout—General Sketch of—Value of Special Remedies—Alkalies and Salines—Diluents—Lithia Salts proposed as Curative Agents—Their Special Action and Advantages—Ash Leaves in Gout—Tonics—Their Value in Gouty Cases—Portland Powder—Discussion of the Liability of Tonics to produce injurious Consequences—Treatment of the Local Affections—Edema—Stiffness of Joints—Chalk-stones—Gouty Abscesses—Diet and Regimen in Chronic Gout—The Prophylactic Management of Gout 417

CHAPTER XIII.

Treatment of Gout:—Mineral Waters—General Remarks on their Employment—Alkaline Waters of Vichy—Mode of Action of—Report on their Value by a Commission of the French Academy—Author's Experience of their Value—Saline Waters of Wiesbaden—Their Nature, Action, and Value in Gout—Sulphuretted Saline Waters of Aix-la-Chapelle—Employment in Gouty Cases—Carlsbad Waters—Influence of Mineral Waters containing little Saline Matter, as of Wildbad, Teplitz, Buxton, etc.—Summary of the Treatment of Gout by Mineral Waters 475

CHAPTER XIV.

Irregular Forms of Gout:—Preliminary Observations—Difficulties in the Investigation of Irregular Forms of Gout—Mode of ascertaining the True Nature of Difficult and Anomalous Cases—Retrocedent or Metastatic Gout—Implicating the Stomach, Heart, and Head—Its Treatment—Gout Affecting the Digestive Organs—The Heart—The Respiratory Organs—Urinary Organs—The Eye—The Ear—The Skin—The Nervous and Muscular Systems—Treatment of the Different Forms of Irregular Gout 496

CHAPTER XV.

Rheumatic Gout:—Remarks on the Use of the Name—Confusion arising from the Employment of the Term—Different Diseases included under the head of Rheumatic Gout—Cases of True Gout to which the Title is given—Cases of Sub-acute Rheumatism—Diagnosis of Gout and Rheumatism—Capsular Rheumatism—Rheumatoid Arthritis—The Chronic Rheumatic Arthritis of Adams—Nodosity of the Joints of Haygarth—Symptoms of—Anatomical Characters—Causes—Pathology—Diagnosis—Table Exhibiting the Differential Diagnosis of Gout, Rheumatism, and Rheumatoid Arthritis—Treatment of Rheumatic Gout—Diseases in Connection with the Gouty Diathesis—Prognosis of Gout and Rheumatic Gout 526

APPENDIX 557

INDEX 597

EXPLANATION OF THE PLATES.

Plate I. (To face page 64.) Fig. 1.—The ear of a gouty subject, exhibiting one small nodule of urate of soda upon the edge of the helix, the only external evidence of chalk-stones visible throughout the body.

Fig. 2.—The ear of another gouty subject, with several deposits on the helix.

Fig. 3.—The great toe of a gouty patient, considerable deposits of urate of soda seen approaching the surface, the veins in their neighbourhood enlarged, and the whole toe inflamed.

Plate II. (To face page 96.)—The arm of a gouty man, in which chalk-stones had become developed to an extreme degree ; the bursa over the olecranon enormously distended with chalk-like matter.

Plate III. (To face page 220.) Fig. 1.—The knee-joint of a gouty man, recently opened, and exhibiting the white plaster-like layer of urate of soda in the articular cartilage on the heads of the femur, tibia, and patella.

Fig. 2.—The section of a thumb, showing the thin layer of deposit on the articular cartilages, also on the ligaments, causing anchylosis, and extending towards the surface.

Fig. 3.—The section of a finger, exhibiting the same phenomena as Fig. 2, in addition to which the urate of soda has pressed upon the phalangeal bones and caused partial absorption ; some of the same matter is seen penetrating the bone itself.

Plate IV. (To face p. 248.) Fig. 1.—The hand of a woman in the early stage of rheumatoid arthritis, or rheumatic gout.

Fig. 2.—The contracted kidney of a gouty subject.

a. External surface, showing the wasting of the cortical portion.

b. Section of the kidney, exhibiting white streaks of urate of soda in the direction of the tubuli uriniferi, and points of the same matter at the end of the pyramids.

Plate V. (To face page 304.) Fig. 1.—A thin vertical section of articular cartilage affected with gouty deposit, exhibiting the crystalline character of the urate of soda, dense towards the free edges of the cartilage, and gradually becoming thinner; external to this deposit a thin layer of organic matter is seen. Linear magnifying power, 220.

Fig. 2.—A thin horizontal section of the same cartilage, taken from a specimen obtained from a limb amputated by Mr. Liston, in 1847. The arrangement of the crystals in stellar groups is well shown. Linear power, 220.

Fig. 3.—Crystals of urate of soda from a semi-fluid chalky concretion. Linear power, 220.

Fig. 4.—Crystallised urate of soda, obtained by evaporating the watery solution of the blood in gout. Linear power, 220.

Fig. 5.—Uric acid, crystallised on fibres from the blood in gout, by the uric acid thread experiment. Linear power, 100 and 220.

Fig. 6.—Oxalate of lime, crystallised on a fibre obtained from the perspiration of a gouty subject. Linear power, 220.

Plate VI. (To face page 358.) Fig. 1.—Different forms of crystals of uric acid obtained from urine. Linear power, 60.

Fig. 2.—Urates of soda and ammonia.

a. Amorphous form.

b. Urate of ammonia from urine of birds and reptiles.

c and *d.* Urates occurring in urine.

Linear power, 220.

Fig. 3. Different forms of oxalate of lime from urine.

a. The octohedral form.

b. Dodecahedra.

c. The ovoid, or dumb-bell, variety.

Linear power, 220.

Fig. 4.—Phosphates of magnesia, ammonia, and lime.

a. Prismatic form of triple phosphate, from neutral or slightly alkaline urine.

b. Stellar variety.

c. Feathery form of phosphates from effloresced blood serum.

d. Phosphate of lime.

Linear power, 220.

Fig. 5.—*a.* Blood discs.

b. Pus corpuscles.

c. Pus corpuscles treated with acetic acid.

Fig. 6.—*a.* Granular cysts of urinary tubes.

b. Organic globules.

c. Epithelial scales.

Linear power, 220.

ON GOUT,

ITS

NATURE AND TREATMENT.

CHAPTER I.

INTRODUCTORY REMARKS:—KNOWLEDGE OF THE ANCIENT WRITERS UPON THE SUBJECT OF GOUT—VIEWS OF HIPPOCRATES—CELSUS—GALEN—ARETÆUS—CÆLIUS AURELIANUS—ALEXANDER TRALLIANUS—AËTIUS—PAULUS ÆGINETA—DEMETRIUS PEPAGOMENOS—THE ARABIAN PHYSICIANS—THE PRINCIPAL AUTHORS OF THE 17TH AND 18TH CENTURIES—EXTRACTS FROM LUCIAN'S POEMS—THE TRAGAPODAGRA AND OCYPUS—CLASSIFICATION OF GOUT ADOPTED BY DIFFERENT AUTHORS—OF DR. CULLEN—DR. MASON GOOD—AUTHOR'S DIVISION.

GOUT is a malady fairly entitled to boast of its great antiquity, for it was probably one of the earliest diseases to which flesh became heir when man began to participate in the luxuries of civilised life. It is a disease, also, which can lay claim to having had among its victims some of the most renowned of the human race, from their position, opulence, and intellect. The great Sydenham, often styled the English Hippocrates, himself a martyr to gout, thus alludes to the subjects most liable to be affected by it:

"For humble individuals like myself there is one poor comfort, which is this, viz. that gout, unlike any other disease, kills more rich men than poor, more wise than simple. Great kings, emperors, generals, admirals, and philosophers, have all died of gout. Hereby Nature shows her impartiality, since those whom she favours in one way she afflicts in another—a mixture of good and evil pre-eminently adapted to our frail mortality:

'Nihil est ab omni
Parte beatum.'"

Among nations in an uncivilised state, living chiefly on the produce of the chase obtained by personal exertion, or subsisting at least on the simplest fare, gout, according to the reports of eminent travellers, is entirely unknown even at the present day; but in our own country, and in many other parts of the civilised world, the case is far otherwise; for not only is gout even in its most marked and typical forms exceedingly prevalent, but in its lurking and undeveloped condition it is probably still more so, and exercises a considerable influence over the character and progress of many other disorders.

These considerations alone render it an object of the highest importance that the disease should be clearly understood in all its bearings.

Another reason for the necessity of a further and accurate study of gout, arises from the fact, that errors in distinguishing it very frequently occur, not only with regard to the more marked forms of the affection, but even with its most common manifestations. It is by no means rare, to hear of inflammation of a joint by one practitioner, called gout, by another rheumatism, and by a third, rheumatic gout; and such discrepancies of opinion, of the highest importance in treatment, often arise from the difficulty of clearly distinguishing its true character on account of our imperfect knowledge of the malady. As we proceed, we shall be able to demonstrate beyond all doubt, that gout is a disease *sui generis*, having a pathology of its own, and producing alterations in the various tissues which it attacks, differing from all other changes,—alterations which are, indeed, completely pathognomonic. If difficulties arise in distinguishing the more regular forms of gout, they are greatly increased when its irregular manifestations require to be discriminated. Although in a highly gouty state of the system, functional disturbance of various organs, and even imflammatory affections may and do arise, depending upon such morbid state,—conditions whose real nature it is most important to determine accurately,—still in practice, even at the present day, the term is not unfrequently applied, more to quiet the patient and satisfy the mind of the physician, than from any evidence that the disease under consideration is strictly connected with gout; for it must be remembered that the occurrence of gout does not ensure exemption from other maladies, and the latter, when they arise, have no necessary relation to the former. A careful perusal of the writings of some of the authors of the last and commencement of the present century, must convince every thinking mind that many of the forms of gout so elaborately described, especially by Continental physicians, have no real existence in nature.

It will be one object of the present treatise, to endeavour more clearly to point out and separate those affections which are distinctly traceable to the gouty diathesis, to found their diagnosis on a more philosophical basis, and thus to pave the way for a scientific and successful treatment.

That the ancients were fully cognisant of the phenomena of gout, and in fact that it was one of the disorders the nature and treatment of which were best known to them, is at once evident from a perusal of their writings. It is true that an undue stress was frequently laid upon the mere seat of the affection, and that different names were not uncommonly applied to the same disease in its different local manifestations, and also that the same name was often given to maladies of a very diverse character; but this should not surprise us, considering their total ignorance of even the rudiments of some of those sciences which are essential to a clear understanding and separation of different pathological conditions of the body. Gout and rheumatism were doubtless often confounded with each other by the Greek physicians; and this remark is also applicable to some pathologists of the present day. However, although the same general term was often applied to both diseases, still it will be at once manifest, from the many quotations from their more important works which we shall have occasion to bring before our readers, that true gout was mostly separated from other joint affections, its peculiar phenomena and progress clearly defined, its various causes ascertained, and its treatment, dietetic and medicinal, carefully laid down.

In general the Greek physicians gave different names to the affection, according to the situation in which it occurred: for example, when the foot was attacked, it was named Podagra (*ποδάγρη*, or *ποδάγρα*, from *ποὺς*, the foot, and *ἄγρα*, a seizure,—*τῶν ποδῶν ἄγρα*, Lucian); when the hand, Chiragra (*χειράγρα*, from *χεὶρ*, the hand, and *ἄγρα*); when in the knee, Gonagra (*γονάγρα*, from *γόνυ*, the knee); and Omagra, Cleisagra, Pechyagra, Dentagra, &c., when either the shoulder, clavicle, elbow, teeth, &c., became the special seat of the disease; when, however, many joints were simultaneously affected, the term Arthritis (*ἄρθρον*, a joint) was more commonly applied. The word gout appears to have been introduced into medicine about the end of the thirteenth century, by Radulfe, and it probably owes its origin to the idea which has been very prevalent in all ages, that the disease was caused by the presence of some peculiar humour in the blood, which was thrown out, or, as it were, distilled into the joints drop by drop; and hence in different modern languages terms expressing the same notion are employed, terms in fact corresponding to our word gout; thus, by the French the disease is called "Goutte," by the Germans "Gicht", by the Italians "Gotta," and by the Spaniards "Gôta," and so forth.

The writings of Hippocrates, who lived about 350 years before the Christian era, show that he was by no means unacquainted with the disease under consideration, and many of his aphorisms indicate the possession of a considerable knowledge of the laws and nature of gout. We find it stated, for example, that gouty affections occur or trouble most in spring and autumn; that women do not have gout until the catamenia have stopped; that young men are free from the disease till venery is indulged in, and that eunuchs are also exempt from gouty affections; and it is likewise stated that gouty patients who have tophi, or chalk-stones in their joints, who have led a hard life, and whose bowels are constipated, are beyond the power of medicine; that the best remedy for them is an attack of dysentery or other determination to the bowels, but that under other circumstances the disease may be cured by a skilful physician. He considered the disorder as dependent on the retention of concocted humours, and advised purging, and the application of cooling agents, even going so far as to pour cold water on the inflamed foot. Although at the present day we cannot perhaps subscribe to all the opinions above expressed, still we must agree in their general truthfulness; for gout usually occurs in spring and autumn, although it often attacks patients at other seasons of the year. Women, again, seldom suffer, at least from the regular forms of gout, until they have arrived at the age when the catamenia disappear; very young men, unless strongly inheriting the disease, seldom have gout, and few who have had much experience in its treatment will entertain very sanguine hopes of a radical cure, when the patient is suffering from chalk-stones and the other deformities so often the sequelæ of the chronic forms of this affection. Some of the aphorisms of Hippocrates were even more correct at the time they were enunciated than at subsequent periods, or at the present day, for luxurious living had not yet been so freely indulged in; probably gout was then unknown among eunuchs, and women were seldom martyrs to it.

The treatment of Hippocrates consisted in administering purgatives either by the mouth or by injection; the drinking of asses' milk and whey, and the affusion of cold water to the affected parts, considering that the pain would be alleviated by any application which induced a moderate torpor of the limb.

Celsus, who lived about the beginning of the Christian era, in speaking of the treatment of gout, remarked that bleeding at the commencement of the attack had the effect of causing some patients to be free from the disease for a year, some even for life;

he also recommends either cold or warm applications, depending on the presence or absence of inflammatory action. He, however, enjoins some caution with regard to the appliance of cold, and recommends a regulated manner of living and the avoidance of corpulence; with regard to the value of exercise, he remarks, "it is very necessary that those who are troubled with nervous pains, such as happen either in the gout of the feet or hands, should give the parts affected as much exercise as possible, and should expose them on all occasions both to fatigue and cold."

Galen, who flourished about the latter half of the second century, was of opinion, that gout was caused by some unnatural accumulation of matters in the part affected; these matters were supposed to consist of phlegm, bile, blood, or a mixture of these fluids, and tophi, or chalk-stones, were considered to be formed by such becoming concrete or solidified. In his comments on the aphorisms of Hippocrates, he remarks, that "though in the time of Hippocrates, eunuchs were not afflicted with gout, yet they are now, in consequence of too much sloth and intemperance. Truly in the time of Hippocrates, on account of their temperance and extreme moderation, on the whole, few suffered from gout; but in our times, luxury and indulgence being so much increased, that it is impossible they can be more so, the number of those who have the gout is infinite." Galen's method of treatment consisted in bleeding and purging, and the application of repellents and discutients; but he remarks that "you cannot give much relief to those who are incontinent, drunkards or gluttons, either by purgatives, or by bleeding; but if they follow your directions, you will benefit them most by bleeding early in the spring, and then paying attention to exercise and diet."

Seneca also, in his epistles, makes a similar remark on the influence of change of manners and habits, as exemplified during the Roman Empire, on the liability to certain diseases, for he says, "the nature of women is not altered, but their manner of living; for while they come up to the men in every kind of licentiousness, they equal them too in their very bodily disorders." "Why need we then be surprised at seeing so many of the female sex afflicted with gout, and also with baldness, contrary to the maxims of Hippocrates, the greatest of physicians, and the best acquainted with nature? Seeing they have by their vices thrown away the natural advantage of their own sex, and by putting off the woman are doomed to suffer all the diseases peculiar to the other."

Aretæus, the Cappadocian, who probably was a contemporary of Galen, and flourished about the middle of the second century, although, like Hippocrates, he classified all joint affections under the term Arthritis, yet subdivided them, according to the parts attacked, into Podagra, Chiragra, and so forth. That he had a very clear conception, and was familiar with many of the phenomena of true gout, is evident from his account of the manner in which it makes its invasion. He states, for example, that "the joints begin to be affected in this way: pain seizes the great toe, then the forepart of the heel on which we lean, next it comes into the hollow of the foot, but the ankle swells last; and they blame a wrong cause; some, the friction of a new shoe; others, a long walk; another, again, a stroke, or being trod upon; but no one will, of his own accord, tell the true one; and the true one appears incredible to the patients when they hear of it. On this account the disease gets to an incurable state, because at the commencement, when it is feeble, the physician is not at hand to contend with it; but if it has acquired strength from time, all treatment is useless. In some, then, it remains in the joints of the feet until death; but in others it spreads over the compass of the whole body. For the most part it passes from the feet to the hands. For to the disease there is no great interval between the hands and the feet, both being of a similar nature, slender, devoid of flesh, and very near the external cold, but very far from the internal heat: next, the elbow and the knee, and after these the hip-joint, which is the transition to the muscles of the back and chest. It is incredible how far the mischief spreads. The vertebræ of the spine and neck are affected with the pain, and it extends to the extremity of the os sacrum: there is a general pain of all the parts of the groin, and a pain peculiar to each part thereof. But likewise the tendons and muscles are intensely pained; the muscles of the jaw and temples, the kidneys and bladder next in succession. And, what a wonder! at last the nose, the ears, and the lips suffer; for everywhere there are nerves and muscles. Callosities, also, form in the joints: at first they resemble abscesses, but afterwards they get more condensed, and the humour being condensed is difficult to dissolve; at last they are converted into hard white tophi, and over the whole there are small tumours, like vari, and larger, but the humour is thick, white, and like hailstones."*

We shall find, as we proceed, that the description above given, is indeed very correct of the progress which gout not unfrequently makes in its more chronic and inveterate forms; and the production of tophi, or chalk-stones, is most accurately described; it is also noted by this writer, that men are more frequently affected than women, and at the same time more slightly (this last statement as far as real gout is concerned, is certainly erroneous); that the most common age is thirty-five, but that it may be sooner or later according to the temperament of the individual. As to the nature of the disease Aretæus says, none but the gods can truly understand, but men may know the probable cause; the explanation, however, which he offers is not such as would be satisfactory at the present day. With regard to his treatment of gout, the following summary contains all that is important. White hellebore is the great remedy, but only in the early attacks. As local applications to the inflamed joints, he advises fresh-shorn unscoured wool from the sheep, and the parts to be bathed with oil of roses and wine; poultices and other warm agents are likewise recommended to be occasionally used. He further adds, that the remedies for the disease are innumerable, for the calamity renders the patients themselves expert druggists. Aretæus considered that although the disease is apt to return and become very chronic, still it is not always so, and he mentions that a gouty patient has, during the interval of the disorder, even won the race in the Olympic Games.

---

* The extant works of Aretæus, the Cappadocian, — Sydenham Society's Works. Edited and Translated by Francis Adams, LL.D.

Cælius Aurelianus* looked upon gout as an hereditary disease, and considered that indigestion, intemperance, cold, debauchery, and injuries, were the principal causes; that the symptoms usually attending persons afflicted with a gouty humour, or those preceding an attack of the disorder, are "a numbness and pricking in the affected joints, a difficulty in their flexion and extension, heaviness, great aversion to employment, and feeling the greatest fatigue from the least motion; a sensation of noise during sleep, proceeding, as it were, from the joints; and upon waking, a sudden starting of the parts; then an unaccountable shivering, or stiffness and tremor all over, till the humour begins so far to prevail, as to discharge itself on one or other of the feet." He was likewise of opinion that the disease was chiefly seated in the tendons and ligaments, and for treatment advises the abstraction of blood from the affected parts by scarification, which he thinks is less irritating than cupping or leeching, and sponging with hot water, or oil and water, or decoction of fenugreek. As a rule, he considers that powerful purging and vomiting are injurious, and altogether is inclined to be sparing in the use of remedies; but rigid as to diet, advising great abstinence at the commencement of an attack, and even on its decline a very spare diet. Exercise is prescribed, to be at first gentle, but afterwards gradually increased. The reason he assigns for the difficulty, nay, even the impossibility, of curing gout, is thus given: "This disorder is so slight in the beginning as hardly to be regarded, and gathers strength more and more from being thus neglected. Hence it meditates a longer continuance, and to take at length entire possession of the body, nor can anything contribute more readily to this than the long intervals whereby it seems to withdraw, and flatters the patient with the vain hopes of being thoroughly cured; for, without doubt, the same intemperance renewed which so often brings on the attacks of this disorder, may likewise greatly contribute to fix it still deeper in the constitution." Again, in remarking on the apparent efficacy of some drugs in mitigating this disease, he says, "It also happens that the pains are of themselves alleviated at the termination of every fit; and thus the remedy, if it chance to be applied at or very near the declension of any paroxysm, shall bear away the honour of the cure; but even should it be allowed to be of real service towards the end of a paroxysm, it must follow, on the contrary, that in the beginning it has all the chance of doing harm."

---

* Cælius Aurelianus, a Latin Physician, a native of Numidia, probably living about the fourth century after Christ. His extant works are three books on Acute and five on Chronic Diseases.

That this caution has been often neglected, not alone in the treatment of gout, but of many other disorders also, will be at once manifest to those who have carefully studied the history of therapeutics.

Alexander Trallianus, who wrote in the sixth century after Christ, considered that, as there were many causes of gout, so therefore there were many varieties of the affection; that sometimes it was occasioned by hot blood flowing into the joints and causing violent pains; at other times by bile getting between the tendons and ligaments, and hence by burning and stretching the parts producing pain; sometimes again that phlegm and other humours became the exciting causes of the paroxysms. He gives methods of diagnosing these supposed varieties, and details their treatment at some length. Where the disease is dependent on an overflow of blood, bleeding is ordered; but in other cases it is said to be contra-indicated. All foods capable of engendering much blood, especially flesh, are forbidden, and strict temperance is enjoined; and he states that he has known some patients to have been cured by altogether abstaining from wine. Purgatives are much prescribed, and combinations of scammony, colocynth, elaterium, and aloes, are recommended; also the hermodactylus, a variety of colchicum, the prejudicial effects of which are ordered to be obviated by combining it with aromatics, as myrrh, anise, pepper, cinnamon, ginger, and mastich. Bitters of various kinds are also recommended, amongst which is the birthwort, which afterwards became so much used in the celebrated Portland powder. Amongst other local applications, we find that sinapisms and blisters are advised, as well as the ordinary repellent lotions; and for the treatment of chalk-stones, ointments containing oil, turpentine, ammoniacum, dragon's blood, litharge, &c., are prescribed.

Aëtius, who also lived at the end of the fifth or beginning of the sixth century, considered gout hereditary, and dependent on local debility, combined with a superabundance of humours; that it was most appropriately treated by first evacuating the latter by means of bleeding and purging, and afterwards strengthening the former. He also attributed great efficacy to the use of friction in gout, not indeed during the severity of the inflammation, but when this had to a great extent abated. He employed oil mixed with salt as an external application; he says, "for all those who use friction in this manner will find their vital heat increased, any redundancy beyond nature shaken off, all useless recrements worn away, the parts affected will become stronger and better fortified against the disorder, and far less subject to it for the future; especially if, when the pains abate, as has been observed before, they carefully put in practice this salutary caution every day, morning and evening, through the whole of life."

Paulus Ægineta,* as Aëtius, considered gout to be dependent on two combined causes, namely, weakness of the affected parts, with a preternatural humour, meeting together. "For when the nutritive powers of the part become debilitated from repletion with food, inducing dyspepsia, the prevailing humour fixing in some of the joints which are already in a weak state, and stretching the nervous ligaments, produces pain." Ægineta regards gouty and rheumatic, or arthritic complaints, of the same nature, and differing only in the seat of the affection, for he says, "when, therefore, the humour is seated in the joints of the feet only, the complaint is called podagra; but when the cause is diffused over all the joints of the body, we commonly call it arthritis, in which the vertebræ, scapulæ, jaws, and every other joint are attacked with the disease. In certain cases the ears, teeth, and pharynx, and sometimes even the liver and spleen, participate in the arthritic pains." He looked upon this so called humour as differing in different cases, as, "sometimes bilious, sometimes sanguineous, and sometimes melancholic, but for the most part it is pituitous and crude, being engendered by excess of food, indigestion, and want of exercise. When the disease is protracted in the joints, the humours become thick and viscid, so as to form what are called tophi, or chalk-stones. Sometimes the humour is of a compound nature, so that the disease is difficult to distinguish and difficult to cure, or nearly incurable. The precursory causes of this affection, for the most part, are immoderate labour, violent walking, frequent exercise on horseback, the unseasonable use of venery, cold drink taken unseasonably, eating of much cold or unwholesome food, and drinking much wine. And some from accidents, as a blow, a sprain, or the like, have experienced the first attack of this complaint; the materials of the disease having previously remained quiet in the system until roused by the proximate cause. Sorrow, care, watchfulness, and other passions of the mind, not only excite an attack of this disorder, but also generate a cacochymy, either primarily or incidentally."

---

* Born at Ægina, lived not earlier than the latter half of the fifth century, or beginning of the sixth.

In the middle or latter half of the thirteenth century, Demetrius Pepagomenos wrote a treatise on gout, dedicated to the Emperor Michael Paleologus. He considered it to be occasioned by a collection of humours taking place in the affected joint, arising from imperfect digestion and deficient excretion from the system: the predisposing causes are said to be excess of food and wine, indolence, indigestion, retention of natural secretions, and debilitating causes, as over-exercise and fatigue and too great indulgence in venery. These last operate by diminishing the excretory powers of the system, and hence allowing undue accumulations to ensue. His treatment is both dietetic and medicinal: the former consists in avoiding indigestion, and exercising great moderation both in eating and drinking; the latter is chiefly of an evacuant character, either vomiting produced by mechanical irritation, as tickling the fauces with the finger or feather, after having partaken of some hot food, as leeks, radishes, &c.; or by purging, which may be effected by scammony, aloes, or the hermodactylus. During the fit of gout, venesection is recommended in the early stage, especially when the patient is plethoric, but afterwards he considers it injurious. The virtues of the hermodactylus are much lauded, and it is regarded as valuable, whatever may have been the cause of the disease. It should be combined with aromatics. If purgatives cannot be given by the mouth, they may be administered in the form of enemata.

The local applications ordered by Aurelius closely resemble those above alluded to under other ancient writers.

Dr. Adams, in his valuable notes appended to the translation of Paulus Ægineta, gives the following sketch of the views of the Arabian physicians. Serapion strongly recommends purging with myrobalans, prunes, and tamarinds. He, Avicenna, and Rhases, join in praising the virtues of the hermodactylus. Their local applications are similar to those of the Greeks. When the pain is violent, Serapion even approves of pouring cold water upon the affected part. Rhases approves of burning the joint in certain cases. Avicenna directs us to cover the part with oil and salt, and thus to apply the cautery gradually. Avicenna speaks more favourably of bathing in thermal waters than any of the other authorities. According to Haly Abbas, arthritic diseases are collections of superfluities in some joint which is labouring under debility. These superfluities are said to be produced by repletion and indigestion. The debility is generally occasioned by immoderate exercise, intemperance, debauchery, or some such cause; and a joint having become weakened, all the impurities of the system are collected into it. He says, that young persons, and women who menstruate regularly, are scarcely liable to gout. He agrees with the authorities already mentioned in holding it to be hereditary. When the humour in the joints concretes into chalk-stones, he pronounces the case to be incurable. When the disease is produced by a sanguineous plethora, he recommends us to begin with bleeding, and then to use cooling lotions, or even to pour cold water on the joint. When these do not succeed, anodyne applications containing opium, mandrake, lettuce, saffron and the like, are to be used. When the pain has abated, any swelling which remains may be discussed by applying to the part a decoction of marjoram, melilot, chamomile and the like. When the defluxion is connected with bile, he recommends first emetics, then drastic purgatives, such as aloes, scammony, colocynth, and hermodactylus. But if the patient's stomach is weak, he prefers milder laxatives. When the defluxion is phlegmatic, that is to say, of a serous nature, he directs us to administer the active cathartics already mentioned, especially hermodactylus; and if it be the summer season, he advises us to give emetics. He cautions us against using local applications of too stimulant a nature at first, lest they dispel the more fluid parts of the defluxion and leave the grosser behind. Alsaharavius calls these complaints collections of phlegm, bile, or blood. He holds that they are often hereditary. Like all his countrymen, he approves of hermodactylus, which he gives in the form of pills with myrobalans, colocynth, turbit, castor, opopanax, &c. When fulness of blood is present, he recommends bleeding.

When chemistry emerged from alchemy, and began to be applied to the study of medicine, views as to the nature of the morbid matter, which had so long been supposed to prevail in the system in gout, were soon promulgated, and for some time the prevailing opinion was that it was of tartareous character, and in many respects resembled the deposits which were seen to take place during the completion of the vinous fermentation in the juice of the grape, or to the tartar which concreted in the wine casks. Serious attempts to refute this doctrine may be seen in some of the older authors on this subject; these views were held during the seventeenth and eighteenth centuries, in fact until the discovery of the true nature of gouty concretions by Wollaston. M. Coste in his "Traité practique de la Goutte," 3rd ed., 1768, thus sums up the views then commonly held as to the nature of the gouty matter. Some have supposed it to be a mixture of various excrementitial humours, different in their qualities and uses; others have thought it a collection of diverse foreign fluid matters, altogether heterogeneous, and by their union capable of producing this malady; a third thinks it merely the perspiration arrested and decomposed; a fourth that it is a mucilaginous extract derived from the solids and liquid aliments taken into the system; and lastly, others assure us that it is a combination of many subtle and penetrating salts. Hoffman states that a salt of tartar, or tartareous acids exist in the blood of the gouty, and constitutes the principal cause of the disease; to prove which, he cites the analyses of several physicians of the stony concretions taken from the joints of gouty patients, as also of their excrements, saliva, and urine, and is persuaded that the tartar of wine is the essential matter of gout. M. Coste, however, contends that Hoffman's opinion must be incorrect, seeing that gout follows almost all other ailments, and causes them to disappear, and that hence from such reasoning, tartar also must be the cause of all these maladies: an opinion, says he, manifestly absurd; and again he asserts, that gout is not uncommon among those who never drink wine, and who, therefore, do not take tartar; M. Coste, however, considers, that although tartar cannot be the sole, still that it is one cause of the disease. His own view of the pathology of gout is not more rational than that of his contemporaries. During the two above-named centuries, the most important writers on gout were Sydenham, Willis, Hoffman, Musgrave, Cheyne, Boerhaave, Meade, Van Swieten, Cadogan, Forbes, and Heberden; but as we shall have to refer to the writings of most of these physicians, and of the still more recent authors of the present century, and expound their views somewhat fully in other parts of this work, we shall content ourselves at present with the mere mention of their names.

Before, however, concluding our history, we will quote a few passages from Lucian's famous comic poems,—one called the Tragapodagra, the other Ocypus; in which many points connected with the nature and treatment of gout are very truthfully, though ludicrously, portrayed, showing that the knowledge of the disease possessed by the ancients was by no means inconsiderable.

First, in reference to the time of year at which the affection is most likely to make its appearance, especially in its early attacks, we find the following:*—

Sed quando ulmi vere tener flos abundat,
Et arguta cantat in ramis merula,

---

* Lucian, a Greek writer, born about A.D. 120. He appears to have suffered himself from gout. A Latin and English Translation of part of his Poems is contained in Van Swieten's Commentaries on Boerhaave's Aphorisms.

Tunc per membra acutum telum hæret mystes
Obscurum, latens, subiens recessus artuum.

"But when the flow'ry elms declare the spring,
And the shrill blackbirds on the branches sing,
Then through our limbs her pointed arrow glides,
Ent'ring unseen, and in the joints resides."

The tendency of gout to come on unexpectedly and during the night, and the desire of the patient, at least in former times, to attribute the affection to some sprain or injury, is well illustrated in the passage where the tutor tells the physician that his patient Ocypus has endeavoured to deceive him.

Mendacia tibi dicta, quæque dicta sunt;
Nec enim luctamve, seu cursum, quod indicat
Exercens ictus est: at hoc mihi credito:
Probe quidem valens primo venit domum
Bene tum saturatus, affatim potus, miser
In lectulo jacens somnum solus capit.
Tum nocte somno excussus, exclamat subito
Divinitus velut ictus: et cuncti timent:
Dixitque, væ mihi! unde tanta vis mali!
Deus ne quis pedem tenens extra rapis?
Sed quæ modo dicebat, finxit omnia,
Dum dira morbi dissimulat mysteria.

"A heap of lies he has told and more will tell
For no one thing he said to him befell;
Trust me he ne'er from wrestling had a pain,
Nor yet in running e'er received a strain;
But full of wine and cramm'd with luscious fare,
Homeward, in hearty health, did first repair:
Then, as the wretch enjoy'd his rest alone,
Waking at midnight with a hideous moan,
Struck as it were from Heaven, alarm'd us all,
And, gods! my feet, my feet, aloud did bawl;
But what he now has told is all a flam
To cover o'er his suffering and shame."

The parts usually affected by the disease, and the intensity of the sufferings which it produces, are shown in the following passages, in which the goddess Podagra is made to speak:—

Ego, quam mordet ira (quidni feminam?)
Morsu hunc remordi certo et insanabili,
Ut est solenne mihi ferire artum pedis;
Et jam dolor dirus parvum tenet locum,
Soleamque terebrat imam punctionibus.

"I, like a furious female vex'd at heart,
Have, as my custom is, with woeful smart,
Fixed in his foot-sole my envenom'd sting,
Which tho' contain'd in little, yet doth bring
Much cruel anguish to his tortur'd feet."

And again, in giving her orders to the gouty powers, she says:—

——— Tu quidem pedum extimas
Soleas adurito, digitos ad usque pedum;
Tu malleolas invade; tuque a femoribus
Ad genua stilla amaram in intima saniem;
Sed vos manuum digitos agite, constringite.

"You—burn the toes and joints of both their feet;
You—prey upon their ankles; from their hips
Down to their knees do you be sure diffuse
The deep corroding juice; and you—as soon
Their finger-knuckles and their wrists invade."

The idea of the almost inseparable connection between pain and gouty inflammation is shown in the passage in which the goddess Podagra says:—

Verum dolor mihi malorum adjutor est;
Nihil ergo namque sum, si ab hoc relicta sim.
Hoc ergo mordet, hoc animum subigit meum,
Dolorem quod malorum originem omnium,

Maleficis maledictis haud quisquam sauciat,
Sed contra me laxant vocem execrabilem,
Mea sperantes evitare vincula.

"But to the fury Pain it is I owe
All my tormenting power of causing woe.
This grieves my soul, this galls me to the heart,
That none should curse the author of their smart:
For without him I 'm nought; and yet you see,
All, all let fly their horrid oaths at me,
With imprecations vile my name profane,
As if by these they could escape my chain."

But to show that pain may exist for a time at the commencement of the attack without any local manifestation, such as swelling and redness, and that gout thus differs from any affection resulting from a blow or other local injury, the physician says to Ocypus, who still endeavours to conceal the real cause of his sufferings:—

Cur non adest gravis inflammatio
Ipso in loco, nec humidum fomentum habes?

"Why was there not a grievous inflammation,
Or, to the parts applied, a fomentation?"

In reference to the treatment of gouty inflammation by local depletion or scarification, Ephorus says to the physician, who has been deceived by the patient Ocypus:—

Soter, quid occipis? sic te fugiat salus?
Audes, quæsitas ferro pœnas addere?
Ignarus omnium, malum admovis pedi.
Mendacia tibi dicta, quaqua dicta sunt.

"What would you do, rash man, with butchering steel,
To add fresh pains to what he now does feel?
Blind to the source of all, how dare you go,
Plague on your haste! his wretched limbs t'undo?"

The numerous remedies employed by the ancients is thus satirised by Lucian, in a passage which needs no English translation :—

> Terunt plantagines, et apia . . . . .
> Et folia lactucarum et sylvestrem portulacam.
> Alii marrubium, alii potamogeïtonem ;
> Alii urticas terunt ; alii symphytum ;
> Alii lentes adferunt ex palustribus lectas ;
> Alii pastinacam coctam ; alii folia persicorum,
> Hyoscyamum, papaver, cepas agrestes, mali punici cortices,
> Psyllium, thus, radicem ellebori, nitrum,
> Fœnum græcum cum vino, gyrinum, collamphacum,
> Cyparissinam gallam, pollen hordeaceum,
> Brassicæ decoctæ folia, gypsum ex garo,
> Stercora montanæ capræ, humanum oletum,
> Farinas fabarum, florum asii lapidis :
> Coquunt rubetas, mares-araneos, lacertas,
> Ranas, hyænas, tragelaphos, vulpeculas.
> Quale metallum non exploratum est mortalibus ?
> Quis non succus. Qualis non arborum lacryma ?
> Animalium quorumvis ossa, nervi, pelles,
> Adeps, sanguis, medulla, stercus, lac.
> Bibunt alii numero quaterno pharmacum :
> Alii octono : sed septeno plures.

And with regard to the absurd ideas and superstitions which were resorted to by gouty patients, it is said :—

> Caminibus alius impostorum luditur,
> Judæus nactus stultum excantat alterum.
>
> "By charms t' allay the pain, some vainly try ;
> To Jewish incantations others fly."

And, lastly, to show the little avail of such kind of treatment, the invincible goddess Podagra, who styles herself, *ἀνίκητον δησπότιν πόνων*, the Insuperable Mistress of Pains, who is not to be appeased by any incense, and becomes more implacable when endeavoured to be pleased by such numerous remedies, says on the contrary:—

> His, qui nihil sapiunt mihi contrarium,
> Animam gero mitem, et fio placabilis.
>
> "But as for those who let me take my swing,
> They find me mild and gentle as a lamb."

We have already alluded to the divisions of gout by the ancients, according to the seat of the affection, into Podagra, Chiragra, and Gonagra, &c., the more modern classifications which are worthy of notice are those of Drs. Cullen and Mason Good. Cullen divided the disease into four varieties, which are thus characterised:—

1. *Regular Gout.*—With a sufficiently strong inflammation continuing for several days, and gradually receding, with tumour, itching, and desquamation of the part.

2. *Atonic.*—With an atony of the stomach or other internal part, and either without the expected or usual inflammation of the joints, or with only slight and transient pains in them, and often suddenly alternating with dyspepsia, or other symptoms of atony.

3. *Retrocedent.*—With inflammation of the joints, suddenly receding, and quickly followed by atony of the stomach, or some other internal part.

4. *Misplaced.*—With inflammation of some internal part, inflammation of the joints either having *not* preceded, or *having* preceded, and quickly disappeared.

Dr. Mason Good, in his "Study of Medicine," divides gout into three varieties, defined as follows:—

α Regularis. Regular fit of gout.	Pain, swelling, and inflammation of the affected joint considerable and acute; continuing for several days, often with remission and exacerbations; then gradually resolving, and leaving the constitution in its usual or improved health.
β Larvata. Disguised; lurking atonic gout.	Disguised and lurking in the constitution, and producing derangement in the digestive or other functions, with only slight or fugitive affection of the joints.
γ Complicata. Retrograde; recedent; misplaced gout.	The disease fixing on some internal organ instead of on the joints; or suddenly transferred from the joints after having fixed there; producing in the internal organ affected, debility or inflammation according to the state of the constitution.

The late Sir Charles Scudamore divided gout into acute, chronic, and retrocedent. Dr. Hamilton and others proposed to divide it still more simply into acute and chronic only. As forced attempts at subdivision and refinement tend rather to complicate than render clear to the mind the various phases which a disease is capable of exhibiting, I shall endeavour in the present treatise to simplify as much as possible; and for this purpose I consider that the phenomena of gout may, for all practical purposes, be grouped under the heads of, 1st, regular gout (acute or chronic), consisting, for the most part, of a peculiar inflammation of the structures within and around one or more joints; and, 2nd, irregular gout, which may be manifested either in severe functional disturbance of any organ, or in the development of inflammation in parts other than those connected with the joints. This last variety would therefore include the various forms classed by different writers under the heads of atonic, misplaced, retrocedent, lurking, ab-articular gout, &c. Many diseases which have been classed under these denominations have no claim to be considered as truly gouty in character, being frequently but the secondary effects arising from alterations in organs, produced either by gout itself, or by the causes which have given rise to this disease.

Some objection may perhaps be made to the use of the terms regular and irregular gout, and it may be asserted, and perhaps with truth, that its so-called irregular manifestations are in fact quite as regular as the articular affection; however, the terms are convenient, and the meaning to be attached to them has been sufficiently explained.

CHAPTER II.

ACUTE GOUT: — DESCRIPTION OF AN EARLY ATTACK — PREMONITORY SYMPTOMS — SEAT AND CHARACTER OF GOUTY INFLAMMATION — PART FIRST AFFECTED — PAIN — EDEMA — DESQUAMATION — NOT FOLLOWED BY SUPPURATION — APPARENT EXCEPTIONS — FEBRILE DISTURBANCE — PROGRESS OF GOUT — LESS COMMON FORMS — ACUTE GENERAL GOUT — SEQUELÆ OF ACUTE GOUT — HEBERDEN'S OPINION OF THE DESIRABILITY OF THE OCCURRENCE OF GOUT — SYDENHAM'S DESCRIPTION OF ACUTE GOUT.

THE phenomena attending an acute fit of gout have been frequently and ably described, and especially by Sydenham, who had, in this respect, the questionable advantage of being able to record what he himself both felt and observed. Although I am unable from personal experience to describe the sensations of gout, I will endeavour to depict the phenomena which have most usually come under my own observation; the present description referring more especially to the first, or, at any rate, an early attack of the disease.

An individual, in his ordinary state of health, or perhaps flattering himself that he is unusually well, goes to bed at his accustomed time; after a few hours' sleep (generally from one to four in the morning), and, probably without any premonitory symptoms, he suddenly awakes, with a pain, more or less intense, in the ball of one great toe, often accompanied with a slight shivering; the pain in the foot continues to increase, and is attended with a sensation of burning and throbbing, together with great tension and stiffness; some heat of skin and other symptoms of febrile disturbance usually follow the shivering, together with a considerable degree of restlessness. After a few hours these symptoms abate somewhat, enabling the patient to obtain a little sleep, and a gentle perspiration commonly ensues. In the morning when the toe is examined, it is found to be swollen, the skin deep red, tense, and shining, and the whole joint exquisitely tender; the veins going from the inflamed part are distended, and full of blood, producing slight lividity, and the appearance closely resembles Plate I. fig. 3, with the exception of the white spots, which in the toe from which the drawing was made, were due to deposits of urate of soda from oft-repeated gouty attacks.

During the height of the fit the pain and sensibility of the affected part is often most intense, to such a degree indeed is this the case, that the patient can neither bear the weight of the bed-clothes, nor even the shaking of the bed from footsteps in the room. Although it commonly happens that after a few hours of torment the pain may abate sufficiently to enable the patient to have some sleep, this by no means always happens, for, if the attack be very severe, the symptoms may continue, though less intense, till the evening, when they again increase, and the second night is passed in a state of renewed restlessness and suffering, which abate only with the dawn of day. Not uncommonly the pain ceases suddenly, and with it the accompanying febrile disturbance. The next evening the symptoms may reappear, subsiding the following morning; and thus the patient often continues to suffer many days, occasionally even weeks, the duration of the attack depending on various circumstances connected with the condition of the patient and the mode of treatment adopted both as regards medicine and regimen.

At the time of the greatest febrile disturbance, the urine is generally scanty and high coloured, sometimes remaining clear, but often giving rise to a dark reddish brown sediment on cooling. The appetite is generally impaired during the severity of the pain, but after this has subsided it may be as good as in health, nay, sometimes even augmented; thirst is usually present when the inflammation is violent; the bowels are for the most part constipated, and the patient is liable to be affected with severe cramps in the muscles of the legs.

When the attack, or as it may be perhaps more properly called, series of attacks, is about to terminate, the inflamed part gradually becomes less tense and swollen, pitting is more readily produced, the redness and enlargement of the blood-vessels disappear, and after a few days, itching of the skin and desquamation of the cuticle ensue, the joint, however, remaining more or less tender for a short time.

In the first fit of gout and sometimes for many attacks, the ball of one great toe is the only seat of the disease; at times, however, the inflammation suddenly leaves this one toe, and the corresponding part of the other foot becomes affected. Sometimes again, the inflammation travels so as to implicate the inner side of the foot; but these instances form the exception rather than the rule, and will be fully described when we have occasion to dwell upon the individual symptoms to which we have previously alluded. The above description refers to the first few attacks of gout in robust and otherwise healthy subjects, and may be taken as typical of acute sthenic gout. Now and then, more especially among women, an acute fit may be wanting in many of these symptoms; there may indeed be much pain and tenderness in the toe, and some amount of swelling, but accompanied with little heat or redness, and all febrile disturbance may be absent; edema is, however, generally observed in the skin of the affected part, and itching and desquamation follow. Such an attack, which may be considered as representing acute asthenic gout, is doubtless of the same nature in its essence or pathology as sthenic gout, the difference depending rather on the character of the subject in which it occurs. These forms of asthenic gout, although at first apparently mild, are ultimately much more hurtful, being prone to assume a permanent condition, and to be attended with consequences far more injurious than the severe and painful fits of genuine sthenic gout.

We have already mentioned that a fit of gout may come on suddenly and unexpectedly, and the absence of premonitory symptoms is generally supposed to occur prior to the first attack of the disease; this may be for the most part true, although, if the patient had been narrowly watched for a few days preceding the fit, disturbance of the function of some organ would probably have been discovered. More generally, for some days before an access of gout, the patient experiences uncomfortable sensations, usually referable to the digestive organs, such as heartburn, acidity, and flatulence, oppression and drowsiness after taking food, hiccup, scanty and high-coloured urine, but sometimes very large in quantity and pale, confined bowels, loss of appetite, lowness of spirits, and a feeling of lassitude; and should the individual be liable to weakness or disturbance of any organ, symptoms referable to such are apt to manifest themselves. Thus some experience palpitation of the heart or intermission of the pulse; others are troubled with hæmorrhoids or irritability of the bladder; others again are annoyed with excessive cramps and itching of the skin; the temper is often considerably ruffled; and in many cases the patient becomes peevish and irritable. If subject to bronchitis or any other chronic affection of the chest, an increase of cough and dyspnœa may precede a fit, and be greatly relieved on the occurrence of the gouty paroxysm.

Such are the symptoms which are commonly experienced, and may perhaps be fairly classed as premonitory of an attack of gout.

Having given a general sketch of a fit of gout presenting the principal characteristics of a typical attack, we will enter a little more fully into the consideration of the various phenomena already alluded to.

The first point to be noticed is, *the seat of the affection.* We have said that it is the ball or metatarso-phalangeal joint of the great toe, and unless there are circumstances in the case which have, as it were, thrown the disease upon some other joint, circumstances which we shall have presently more particularly to notice, true gout, at its first invasion, seldom attacks another part, and even if another be first affected, the ball of one great toe is probably so likewise. Sir C. Scudamore drew up a list of 516 cases of gout, for the purpose of determining this point; and from his table we find that one or both of the great toes alone were affected in 341 instances, and the great toe with some other part in 373 cases. The details of the table are seen below.

In the great toe of one foot only . . .	314
In the great toe of each foot	27
In the knee and great toe	1
In the little toe and one adjoining . . .	1
In the great toe and instep	4
In the great toe and instep of each foot . . .	2
In the great toe of one foot and instep of the other .	1
In the great toe, instep, and ankle of one foot . .	1
In each great toe and each hand . . .	1
In the external side of the foot and the great toe . .	1
In the external side of one foot and the great toe of the other	1
In the heel and the great toe	2
In the ankle of one foot and the great toe of the other .	5
In the ankle and great toe of the same foot . .	11

In the tendo Achillis and the great toe of the same limb	1
In the outer side of one foot	10
In the outer side of each foot	1
In the sole of the foot	4
In the heel of one foot	6
In the heel of each foot	2
In the heel and instep of the same foot	2
In the heel of each foot, in each hand and each elbow	1
In the ham	1
In the knee	11
In each knee	1
In the instep of one foot	25
In the instep of each foot	6
In one instep first, afterwards each knee, each wrist, each elbow, and each shoulder	1
In one ankle	36
In each ankle	11
In the ankle and instep of one foot	4
In the tendo Achillis	4
In the tendo Achillis and ankle	1
Calf of the leg	1
In the thumb, knee, ankle, and great toe on one side, and lastly, the great toe of the other foot	1
In the right knee and left hand at the same time	1
In the back of one hand	4
In the wrist	4
Thumb and hand	1
In the thumb	1
In two middle fingers	1
In one middle finger	1
In the fourth finger	1

My own experience fully confirms the results of the above table, as to the frequency of the great toe being specially selected; and I am fully convinced that in many cases of joint affection, where some difficulty would otherwise exist as to the precise nature of the disease, considerable light may be thrown upon the subject by directing attention to this fact; it appears remarkable that this particular joint should be selected by the disease upon which to vent its first fury; however, so it is; and when we shall again have occasion to recur to the point in discussing the nature of gout, we may possibly be able to give something like a rational explanation of this phenomenon. From an investigation of the history of a considerable number of cases of true gout, I find that in not more than five per cent. were other joints stated to be implicated, to the exclusion of the great toe; and authors, both in this country and abroad, seem to be fully agreed upon the matter. In point of frequency in being attacked, the ankle seems to be second to the ball of the great toe, afterwards the instep, next the outer side of the foot, then the knee, &c.; whereas, the upper extremities are seldom implicated in the earlier attacks of the disease.

The extreme frequency of the affection first locating itself in the ball of the great toe, cannot be looked upon as a mere fortuitous circumstance, but is intimately connected with the pathology of the disease; and when deviations from this rule are found, they depend on peculiar influences which are then brought into operation, some possibly existing within the patients themselves, but perhaps more commonly arising from without. The most potent cause of such deviations is the occurrence, either at the time or on some prior occasion, of injuries, such as bruises or sprains. I possess many Notes of cases more or less resembling the following: A gentleman with a strongly marked hereditary predisposition to gout, one day hurt his knee from a fall when hunting. The pain was not very severe at first, but in the course of a few hours became intense, much more so than could be accounted for from the nature of the injury; it soon, however, became evident that the joint was affected with acute gout, which was speedily relieved on the ball of the great toe of the same side becoming inflamed. After two years, this patient had a second attack of gout, which was then confined to the ball of the great toe. Sir C. Scudamore relates the following case: A gentleman, when a youth, accidentally received some small shots from a gun in one knee. They were removed, but the knee was rendered permanently weak; and to this injured joint gout, in after life, first attached itself, and always afterwards with more severity than any other situation. Many other examples might be quoted, illustrative of the influence of local injury in causing gout to appear in parts not usually first affected, such as the ankle, elbows, &c.; but as we shall have occasion to refer to this subject when speaking of the exciting causes of the gouty paroxysm, we will content ourselves with the instances above given.

The *character of the inflammation* next deserves our attention. We have said that there is much pain, and there appears to be something peculiar about this symptom; it is often very intense indeed, and differs considerably from that produced by injury; a gentleman, for example, who broke his leg and then had a fit of gout in the opposite great toe, expressed his opinion that the pain of the latter far exceeded that of the former. Sometimes it is described as resembling the gnawing of the part by a dog, the dislocation or tearing of the joint asunder, and so forth. Dr. Watson, in his admirable Lectures on the Principles and Practice of Physic, gives the description by a humorous Frenchman of the distinction between the pain in this disease and in rheumatism: "Place," says he, "your joint in a vice, and screw the vice up until you can endure it no longer, that may represent rheumatism; then give the instrument another twist, and you will obtain a notion of gout." Now and then, however, cases of gout are met with, in which the pain does not appear so intense, although the inflammation may run high, and I have known several first attacks of the disease in which this has occurred; they form, however, the exception rather than the rule.

The production of *edema* of the gouty part, and the subsequent *desquamation of the cuticle*, is a peculiarity of gouty inflammation when it attacks superficial structures, and one deserving attention; for although it cannot by any means be considered as pathognomonic, still it is sometimes of considerable value in diagnosis. During the early stage of an attack, when the inflammation is violent and the skin distended and shining, the edema cannot be readily observed, on account of the tension; when, however, the inflammation begins to subside, pitting can be easily produced and the presence of fluid made evident. As a rule, true rheumatic inflammation is not accompanied by edema: now and then, however, it does occur in undoubted cases of the genuine acute disease; but it is then more general in character, affecting the whole limb, and so not strictly confined to the inflamed part, as occurs in cases of uncomplicated gout. The desquamation of the cuticle is a subsequent symptom, taking place after the complete subsidence of the gouty paroxysm; it is most usually observed about the feet and hands, and but rarely from the knees; it seems, as far as my own experience goes, to bear some relation to the amount of the previous edema, and the consequent distension of the skin. Now and then, even the nails have been shed after a severe attack of gout. Prior to and accompanying the desquamation there is often a considerable itching; a symptom which frequently follows any other slight injury to the skin, as the application of a blister. Sir C. Scudamore observed that in 234 cases, seventy-eight patients never experienced any desquamation, and in my own Notes I find several in which this symptom is not noticed; but it must be remembered that it is one readily overlooked, unless specially sought for. With regard to the cause of edema occurring so frequently in gouty, compared with other forms of inflammation, nothing very satisfactory has yet been made out: may it not depend on the impurities in the blood? may not the presence of urate of soda and a small amount of urea in that fluid, be at least one cause? As we proceed we shall discover that the blood in gout differs much from that in rheumatism, especially as regards the presence of excrementitial matters.

Upon the *temperature of the parts affected* with gouty inflammation, there is nothing of importance to remark; patients often express themselves as suffering from intense heat of the inflamed joints, but the thermometer shows no more increase of temperature than is ordinarily found in many other forms of inflammatory disease; the extraordinary sensation of heat, therefore, which is sometimes felt by the gouty, must arise, not alone from increase of temperature, but from a peculiar exaltation and perversion of the nervous function. Gouty inflammation differs from common phlegmonous inflammation in some other very important points, and especially in *not being followed by suppuration.* If a medical man, by chance entirely ignorant of the nature of gout, were to see the toe affected with this disease in its full intensity, swollen, red, hot, and tender, he would probably think that it must necessarily terminate in suppuration; yet I believe this never happens in true and uncomplicated gouty inflammation. I have seen cases which at first appeared to favour the idea that suppuration sometimes does occur; but, on further investigation, other circumstances were proved to have been the real cause of the formation of the matter.

A man, C. F., was attacked with a violent fit of gout, affecting many joints, and, among others, the first phalangeal joint of the right index finger; the swelling rapidly increased, was accompanied with much pain and redness, and in the course of four days gave distinct evidence of the presence of fluid; a small puncture was made with the point of a lancet, and some drachm or more of a whitish or milky-looking liquid escaped, containing pus globules, mixed with numerous crystals of urate of soda aggregated into small masses. It was afterwards found that some deposits of this salt had previously existed in the part, and the suppuration was doubtless owing to the inflammation occurring around a foreign body. Sir C. Scudamore states in his work, that he only found the occurrence of suppuration in eight cases, and noticed that in each instance the result was curiously modified by an attendant secretion of urate of soda. I believe that in all of them, had they been specially examined, urate of soda would have been found to have been previously present in the tissues. I have never myself witnessed, and I am not aware of there being an example on record of a *first fit* of the disease, however intense, and where there could have been no prior deposition, being accompanied with the production of pus.

I believe it may be considered as the rule, that in acute gouty attacks the amount of *febrile disturbance*, indicated by the rapidity and force of the pulse, the increased heat of the surface, thirst and loss of appetite, bears a close relation to the extent and severity of the local inflammation; that the fever is, in fact, chiefly symptomatic, and thus differs greatly from what occurs in acute rheumatism, where the highest febrile disturbance may exist without any proportionate inflammation of the joints. Although the skin is frequently moist during an attack of acute gout, still the profuse and peculiar sweating so commonly met with in acute rheumatism, is never present.

The following cases illustrate the close relation existing between the febrile disturbance and the amount of local disease.

January, 1855.—H. C., ætat. 32, had his first attack of gout, when 28 years of age, confined to the ball of the left great toe, which was red, hot, swollen, painful, and afterwards pitted freely on pressure, and lastly, gave rise to desquamation of the cuticle. For two years after the first fit had a return each year about Christmas; but within the last two years, an additional one in the summer. The fits have gradually increased in severity, and the number of joints implicated have become more numerous at each visitation. When first visited, the ball of the left great toe, instep, and ankle, were swollen, red, hot, and painful; the corresponding parts on the right side were similarly affected, although in a less degree. The left wrist, hand, and elbow were much inflamed, as likewise the same joints on the right side; the knees were by no means free.

This case affords an example of acute gout affecting many joints, and the febrile disturbance will be seen to be of corresponding intensity: the pulse, for example, was hard and full, 108; the skin hot and dry; the tongue furred, with much thirst. After a few days' treatment, the joints were relieved, and the pulse became soft and only 74 in the minute.

The next case presents an example of the acute affection, in which one joint only was implicated.

November, 1854.—J. P., ætat. 44, had his first attack of gout at the age of 40; the second, two years afterwards, the present being his third fit. Is now complaining of great pain in the ball of one great toe, which is much swollen, hot, red, and pitting a little on pressure. Tongue furred, and some thirst. Pulse 78, and no symptom of fever.

It will be commonly found that in cases of gout, when but few joints are affected, the pulse, if not quickened by the intensity of the pain, is but little accelerated, nor are the other signs of febrile disturbance at all prominent. The condition of the tongue depends greatly upon the state of the patient's stomach and bowels, which organs are often much deranged in gouty individuals.

We will now, having shown the most important phenomena usually attendant upon a first or early attack of gout, pass on and endeavour to trace the future progress of the disease. Occasionally a patient experiences but a single attack of gout, but this rarely happens if his life is prolonged. By far its most usual course is to return after an interval more or less lengthened in different cases, depending on the patient's constitutional tendency, the mode of living, or the amount of predisposing and exciting causes to which he is subjected. Sometimes several years elapse between the first and second fit; more commonly about two years, frequently one only, and now and then but a few months respite is afforded. Generally, as the disease becomes grafted into the constitution, the attacks are more frequent, and at the same time more general in their character. In cases of gout where the patient lives within moderate bounds, and where the hereditary predisposition is not very great, the disease may be confined to the ball of one or other great toe for several attacks, or even for a period of many years, but the tendency of the disorder is to travel upwards, affecting first the ankles, then the knees, and afterwards the hands and elbows, and still later other joints of both upper and lower extremities. So frequently do we meet with this or some such similar order, that the history of a case will often be sufficient guide by which to form a correct diagnosis as to the real nature of the disease.

My Note-books afford abundant illustrations of what I have now stated; it will be sufficient, however, to give shortly the details of the time and situation of the attacks as they occurred in one patient.

1857.—C. M., ætat. 55 years, not inheriting gout from either father or mother's side, but having a brother who has been slightly affected with it. The patient's first fit occurred fourteen years ago. He remembers having gone to bed feeling quite well, and about four o'clock in the morning waking up with pain and stiffness of the ball of the right great toe, which soon became red, hot, and swollen. The fit lasted about three weeks; at least, this time elapsed before he could wear his boot. No other joint was attacked.

The second fit occurred at the end of a twelvemonth, affecting the very same joint, at the same time in the morning, and lasting altogether about a fortnight. For the next six years, the attacks occurred annually, and were confined to the metatarso-phalangeal joints of one or other great toe.

Six years ago, the upper extremities first became implicated, the disease attacking the wrists, knuckles, and phalangeal joints. The paroxysms usually lasted about fourteen days, and were followed by desquamation of the skin. Until within the last twelvemonth, the fits have occurred uniformly at the same time of the year, but since that period they have been more frequent and irregular. More than half the cases of genuine gout exhibit a history more or less resembling the above.

It is indeed astonishing to find how regularly the returns of gout occur, for not unfrequently patients are able to calculate the time, even within a few days.

Although it generally happens that the great toe is first affected in gout, or at least becomes implicated during the progress of the fit, still this is not invariably the case, and we must not conclude that a disease is necessarily not of a gouty nature, simply from the absence of its occurrence; for now and then striking examples present themselves of genuine gout, the great toe during the whole time remaining quite free: these cases occasionally offer considerable difficulties in diagnosis, and their careful study is of much importance. The following is an instance:—

October, 1858.—H. P., a male, aged 38, came under my care in the hospital, on account of severe suffering in both ankles. It appeared from the history of the case, that his father had been greatly afflicted with some joint affection, to such an extent as to cause him to be bedridden for sixteen years; it was considered to be rheumatism. The patient, when fifteen years of age, had an attack of what appeared to be rheumatic fever, affecting the wrist and other joints of the upper extremities; seven years after this first attack, he had a second of similar character, but implicating the lower extremities also. From this time to his admission, he had suffered at four or five different periods, the disease generally assuming a chronic form, and rendering him helpless for many months. He cannot remember that the ball of the great toe was ever implicated. By occupation he is a cellarman, and is exposed to cold and damp; he takes on an average each day, at least four pints of pale ale or other malt liquor, and sometimes a considerable amount of wine. On admission both ankles were very painful and tender, but not swollen or red. He is unable to flex them, and the least attempt to do so is accompanied with much pain. The attack had been present three weeks, and at the commencement, from the patient's own account, the joints were swollen and red; pulse 72; tongue but slightly furred and no thirst; appetite moderate; bowels regular; no perspirations. The pain in the joints was somewhat increased at night. The urine was scanty, sp. gr. 1030, giving rise to some crystalline deposit of uric acid on standing; no albumen present. As there was some doubt as to the real nature of the disease, about two ounces of blood were taken from the arm, and the serum exhibited the presence of a moderate amount of uric acid when treated by the thread experiment detailed in a subsequent chapter.

A draught, containing four grains of iodide of potassium in camphor mixture, was also prescribed, and middle diet ordered. Four days afterwards, the patient remained in much the same state. The joints were somewhat relieved from the perfect quiet, regulated temperature, &c. It being found upon inquiry, that the patient had usually taken pale ale in preference to porter, from considering it better adapted to his disease, and as he thought he felt more pain in his joints after taking stout, and moreover as the examination of the blood had shown the existence of an abnormal quantity of uric acid, I deemed it advisable, in order to arrive at a correct diagnosis, to see the influence of diet upon the patient, other circumstances remaining the same. For this purpose, as the appetite had become good, the extra full diet of the hospital was allowed, with the addition of two pints of porter, medicine being at the same time omitted. For the next four days all went on satisfactorily, but on the fifth he complained of severe pain, first in the right and then in the left ankle, which parts were soon swollen and red, and two days afterwards pitted freely on pressure, and gave rise to desquamation of the cuticle; the tongue was furred, pulse above 100, but no marked thirst. The porter and meat were then discontinued, and a draught, containing half a drachm of colchicum wine in camphor mixture, administered three times a day. Within forty-eight hours, the ankles were greatly relieved, and in a few days quite free from swelling or redness, and altogether in a much healthier state than since the commencement of the attack; the colchicum did not produce either nausea or looseness of the bowels.

The peculiarity of this case, or what prevented the great toes from becoming affected, it is difficult to determine. May not the acute rheumatism in early life have left a certain amount of alteration in other joints, predisposing them to become subsequently affected by the gouty poison? We find that after accidents, and like causes, weakened parts are more susceptible to its influence.

No deposits of gouty matter could be discovered, but the first phalangeal joint of the right little finger was flexed and almost anchylosed, whether or not by the deposition of urate of soda in and around the joint it is impossible to say. However, the character of the inflammation, the condition of the blood, the influence of diet, and the striking effect of colchicum upon the disease, can leave no doubt that the case was one of true gout; and there can be no reason why a patient, who was in early life subject to rheumatic fever, should not acquire in after years the gouty diathesis.

We have said that gout in its early attacks ordinarily selects one, or at least only a few joints, and that the smaller articulations are more particularly fixed upon. Exceptions, however, to this law, now and then occur, in which not only are the larger joints implicated, but their number also augmented, and then there is often much difficulty, at least at first, in making a correct diagnosis, as these cases resemble very closely those of acute rheumatism. A very remarkable instance of this form of acute general gout came under my care a few years since, and was one in which the subsequent phenomena left no possible doubt of its true nature.

December, 1853.—C. F., a man aged 35, was brought to the hospital under the following circumstances. He had on the previous day been struck in the infra-axillary region by the shaft of a cart, which had knocked him down and fractured one or more of the left ribs. He was admitted into a surgical ward, and as there was evidence of some small amount of traumatic pleurisy, he was ordered to be cupped over the chest, and to take every three hours three-grain doses of blue pill and half a grain of opium. In the evening he felt pain in the left elbow-joint, and during the night the fingers of the same hand became red and swollen, in addition to which the soles of the feet and right knee were involved. As the case assumed more of a medical than surgical character, the patient was next day (two days after the injury) transferred to my ward, when his condition was as follows:

Countenance pale and sallow; pulse 108, rather small, but hard; skin hot and somewhat moist, tongue furred, gums red and swollen, and breath mercurial; much thirst, and want of appetite. The joints affected were the left wrist, hand, and elbow, which were hot, red, and swollen; the right knee and ankle, and little toe of the left foot, were also swollen and painful. A friction sound was heard from the middle of the left back of the chest round to axilla.

The next day most of the inflamed joints pitted distinctly on pressure, and the middle joint of the right index finger was much swollen, the circumference being at least twice that of any other; the skin also was very hot and red, and the whole finger exquisitely tender and painful. On the following day the condition of the patient was much the same. Up to this time the case had been looked upon as one of acute rheumatism, and the treatment had been such as is then usually adopted; but I now suspected that my first diagnosis was erroneous, and that it was in fact one of genuine acute gout: the reasons for my suspicions were—First, the blood drawn by cupping from the chest was found on examination to be rich in uric acid; Secondly, the character of the inflammation was such as is almost always found in true gout and but rarely in rheumatism, the more important points being the shining appearance of the inflamed skin and the subsequent pitting on pressure; Thirdly, the fact of the patient being so readily affected by mercurials—an occurrence by no means uncommon in gout, but rare in acute rheumatism; and lastly, I was led not only to suspect, but to feel assured, that the patient was labouring under acute gout, from the future progress of the case. In the course of a few days the swelling of the right index finger increased to such an extent as to present the appearance of intense distension, and gave rise to the feeling of distinct fluctuation; at the same time the other joints were greatly relieved, and the febrile disturbance had abated under the influence of the colchicum which had been administered. Shortly afterwards, on puncturing the distended skin of the finger, a milky fluid exuded, which, under the microscope, was found to owe its opacity to innumerable crystals of urate of soda, in the form of very fine needles (Plate 5, fig. 3). On making further inquiries into the history of the case, I ascertained that this was not the first attack of joint affection he had experienced. About fifteen months previously he had laboured under some inflammation of the foot, with the characters of ordinary gout. In the course of a few weeks the nature of the case was still more clearly established, from the fact that a small deposit of urate of soda occurred in the helix of one ear; and since that period, now about five years, chalk stones have formed in different parts, and gouty symptoms have from time to time been exhibited in their ordinary type, in the great toe and elsewhere. The patient was a painter by trade, had drank about a quart of porter each day, and appears to inherit gout from the mother's side: two of his brothers have since been my patients, suffering from the same disease.

Many cases of acute general gout, more or less allied to the one just quoted, have been described and regarded as attacks of acute rheumatism. I am inclined to think the following, which is classed as one of acute rheumatism developed during an attack of acute gout, is an example of this fact; it is related by Mr. Spencer Wells in his interesting work on this subject:—"A gentleman about forty years of age, descended from gouty parents, and accustomed to indulge rather freely in the pleasures of the table, about five years ago had a slight attack of gout under the ball of the right great toe. This soon went off, but at intervals of three or four months similar attacks had recurred, their severity and frequency both being on the increase. One evening he felt that an attack was threatening but he attended late in the House of Commons, and, as the pain was increasing, he thought a day's exercise would probably ward off the attack, as he had found it do so before. Accordingly, on leaving the

House, he posted all night between seventy and eighty miles to have a day with his hounds. He arrived but just in time to equip for the field, and had one or two short runs and a very long one, in the midst of the rain, on a cold day. He had to ride fifteen miles on a tired horse, on returning, and when he reached home had to be lifted from the saddle and carried to bed. He took hot brandy and water, but a severe rigor came on, and a general attack of acute rheumatism set in on the following day. It was so severe that the gouty inflammation of the foot was disregarded, attention being given to the state of the heart and general condition. In about a fortnight he was convalescent, so far as the rheumatism was concerned, but the gouty action continued in the foot, and did not disappear until a few doses of colchicum had been given." Another case from the same author, and considered to be likewise one of acute rheumatism in a person affected with chronic gout, is as follows: "A gentleman affected with chronic gout, having considerable deposits of lithates in the fingers and around the ankles, and being subject to copious urinary deposits of varying composition, passed some time in Malta to obtain the advantages expected from living in a warm climate. After a very hot day he remained in a boat in the harbour, fishing, for some hours, on a moonlight evening. He had been perspiring freely in the afternoon, and was lightly dressed. He felt rather chilly before he went home, had a severe shivering fit in the night, and was confined to his bed for twelve days with a smart attack of acute rheumatism affecting the knees, shoulders, and loins, but not any of the joints which had previously been affected by gout."

That many cases of acute gout have been mistaken for acute rheumatism, I have no doubt in my own mind; and on the contrary, that some few cases of acute rheumatism have been called gout, I am no less certain; as an example of the latter I may refer to the oft-quoted one by Dr. Haygarth, in which the disease is supposed to have been transferred from the extremities to the heart.

The early attacks of gout are not usually followed by any very appreciable evil consequences, and as one of the effects of a severe paroxysm is to rid the blood of the impurities which had probably been lurking there for some length of time, it is not uncommon to hear patients express themselves as even benefited by the occurrence of the gouty fit. Hence, gout was formerly looked upon as a salutary disease, and one capable of removing all others; the error of this opinion is readily demonstrated, and as evidence we shall be able to show that every attack is attended with permanent local mischief, which though slight at first, may, by frequent repetition, be sufficient to induce serious inconvenience. This opinion is now fast wearing out, even amongst the public; intelligent physicians have long exposed its fallacy, and have combated it, as shown by the following passages from Heberden's Commentaries, and Coste's *Traité pratique de la Goutte.* Heberden thus remarks: "Some, indeed, in the first attack of gout, congratulate themselves upon the completion of their wishes, and during the honeymoon of the first fit, dreaming of nothing but perfect health and happiness, persuade themselves that they are much the better for it; for new medicines, and new methods of cure, always work miracles for a while. Of such we must not inquire, but of those who have had it their companion for a great part of their lives. Now, among those gouts which I have had opportunity of seeing, I find by the notes which I have taken, that the patients in whom they have supervened other distempers without relieving them, or where they have been thought to bring on new disorders, are at least double the number to those in whom they have been judged to befriend the constitution; and it has appeared to me, that the mischief which has been laid to their charge, was more certainly owing to them, than the good which they had the credit of doing. Other disorders will, indeed, be suspended upon an attack of the gout, and so they will by palsies, fevers, asthmas, small pox, and madness, of which I have seen many instances; but then the gout has often come on when persons were labouring under vertigos, shortness of breath, loss of appetite, and dejection of spirits, without affording the least relief, and sometimes it has manifestly aggravated them; nay, these complaints have in some patients always come on with the gout, and have constantly attended it during the whole fit. If the gout return but seldom, and its stay be but short, the patient may be very little the worse for it, just as he might have had an epileptic fit once a year, and yet might die in a good old age. However, the health, as I have observed, will sometimes begin to decline even from the first fit, and gradually sink from that time under the usual signs of an irreparably shattered constitution; when, though there might be some doubt whether the gout occasioned the mischief, yet there could be none that it did not prevent it."

M. Coste writes to this effect:—"A popular error, which I wish to expose in a few words, is this prejudice, which has already lasted more than two thousand years, and which has reached even the thrones of princes, where the disease commonly shows itself, viz., that gout prolongs life (*que la goutte prolonge la vie*). This error," says he, "has taken the surest method of introducing itself, by making flattering promises, by persuading its victims that there is a singular advantage in having gout, and that the malady drives away all other evils, and that it ensures long life to those whom it attacks."

Occasionally it happens that a patient does not quickly get rid of the ill effects of a sharp attack, even of early gout, for the affected parts may remain exquisitely tender for a long period of time, although no appreciable structural mischief has taken place; sometimes, again, there remains a considerable tendency to edema, and more especially if the fit has been of long duration. A case occurred in my practice a few years since, bearing forcibly upon this point.

A gentleman enjoying good health, with the exception of occasional attacks of gout, consulted me on account of his suffering from swelling of the feet and ankles, remnants of the last fit of the disease. Hitherto he had been accustomed to apply to his usual medical adviser, and he generally was restored to health in about ten days or a fortnight. He had, however, been persuaded in the last attack, to put himself under the treatment of a homœopathic practitioner, and had complied strictly with his injunctions regarding both medicine and regimen. At the end of the fortnight, instead of finding himself able to go about as formerly, the disease was still present in its full intensity. He was comforted, however, by the assurance that, although the cure might be slow, yet it would be the more complete, and thus he continued to bear his sufferings for seven weeks, until the affection had fairly worn itself out, with the exception of leaving behind much tenderness of the parts and the edema, for which he was now desirous of obtaining advice. On examining the urine, it was found free from any trace of albumen, and the only cause for the swelling which could be discovered was the great weakness of the vessels left by the prolonged inflammation. Very simple treatment adapted to remove any remains of gout, together with the use of the elastic stocking, proved sufficient for the cure. This case illustrates the fact that, even with great care as to diet and other circumstances, the disease may prove very tedious; and I am of opinion that we shall be convinced, before we arrive at the consideration of treatment, that such duration is necessarily accompanied with the production of serious mischief, and should be curtailed when possible by the application of appropriate remedial measures; those who have had many opportunities of witnessing the progress of gout will, I believe, be by no means inclined to agree with Cullen's aphorism: "The common practice of committing the person to patience and flannel alone, is established on the best foundation."

Although the earlier attacks of gout are usually unattended with a great amount of subsequent inconvenience, this is by no means invariably the case; for I have known the formation of chalk stones occur very shortly after the commencement of the disease; and, within a period of two or three years, increase to such an extent as entirely to cripple the patient. Such an occurrence, however, forms the exception, and not the rule, in the progress of gout; for, on the other hand, many cases have come before me in practice, in which the patients have suffered, more or less, for forty or fifty years, without perceptible inconvenience.

At times, without any apparent intensity of local inflammation, acute gout, even in its first attack, will cause permanent stiffness, or complete anchylosis of the joint; and this will occur with very little or no accompanying enlargement or appearance of chalk stones, though attended with serious changes in the deeper structures.

A recent case well exemplified this statement:—J. P., a male patient, fifty-six years of age, by occupation a fishmonger, having no known hereditary predisposition to gout, has been accustomed to drink pretty freely of porter and gin, certainly as much as four pints of the former, and half-a-pint of the latter per diem, sometimes more. About five or six years since, when going up-stairs with a heavy weight, his foot slipped from one stair to the next, but he did not consider that he had hurt himself; about two or three days after, the ball of the great toe became very painful, red, swollen, and hot, and the attack lasted from three weeks to a month, no treatment being adopted except rest in bed. Since that period he has occasionally had pains in this joint, but has never been again laid up with it. Although there has been but one distinct attack, the joint is completely anchylosed. About eleven months ago he had pain and swelling of the right ankle, and also of some of the joints of the fingers, several of which were left partially anchylosed. The attack for which he came under my care commenced about ten days before, with pain in the right ankle and two of the fingers of the left hand; two days after the pain left the right and attacked the left ankle, and subsequently the knee on the same side. At the time he was first seen there was considerable swelling of the first phalangeal joint of the middle finger, and pain was occasioned on attempting to move it; the ankles were little swollen, but tender on pressure.

The joint attack came on shortly after an operation for hemorrhoids. One of the phalangeal joints affected during the last attack remains swollen and stiff, and appears to have become partially anchylosed.

Another instance has come under my notice, of a gentleman who, although free from all appearance of deposits, has complete rigidity of the ball of one great toe, the result of several fits of acute gout; on the other hand, patients may have repeated attacks, and yet no very perceptible rigidity ensue, although we shall find the structures of the joint considerably affected.

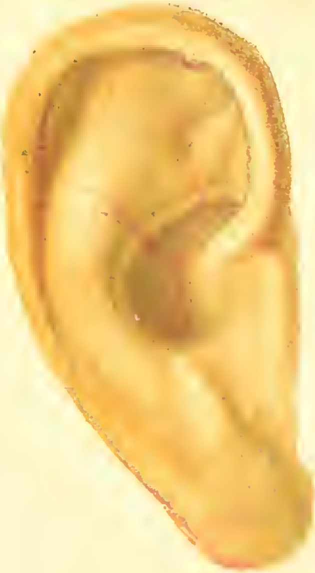
Before concluding this chapter, I cannot refrain from giving the passage from Sydenham,* although often before quoted by authors, in which he describes the gouty fit; the description is so graphic and vivid, the result of acute and severe personal suffering:—

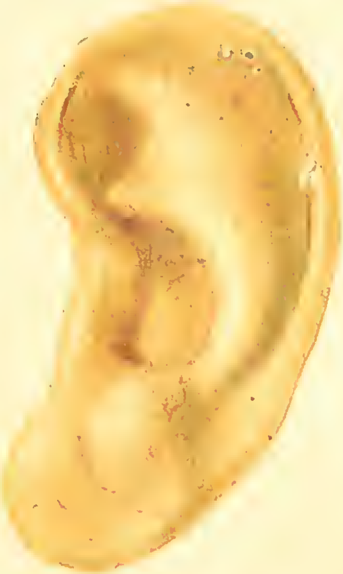
"Towards the end of January or the beginning of February, suddenly and without any premonitory feelings, the disease breaks out. Its only forerunner is indigestion and crudity of the stomach, of which the patient labours some weeks before. His body feels swollen, heavy, and windy—symptoms which increase until the fit breaks out. This is preceded a few days by torpor and a feeling of flatus along the legs and thighs. Besides this, there is a spasmodic affection, whilst the day before the fit the appetite is unnaturally hearty. The victim goes to bed and sleeps in good health. About two o'clock in the morning he is awakened by a severe pain in the great toe; more rarely in the heel, ankle, or instep. This pain is like that of a dislocation, and yet the parts feel as if cold water were poured over them. Then follow chills and shivers, and a little fever. The pain, which was at first moderate, becomes more intense. With its intensity the chills and shivers increase. After a time this comes to its height, accommodating itself to the bones and ligaments of the tarsus and metatarsus. Now it is a violent stretching and tearing of the ligaments—now it is a gnawing pain, and now a pressure and tightening. So exquisite and lively meanwhile is the feeling of the part affected, that it cannot bear the weight of the bedclothes nor the jar of a person walking in the room. The night is passed in torture, sleeplessness, turning of the part affected, and perpetual change of posture; the tossing about of the body being as incessant as the pain of the tortured joint, being worse as the fit comes on. Hence the vain efforts, by change of posture, both in the body and the limb affected, to obtain an abatement of the pain. This comes only towards the morning of the next day, such time being necessary for the moderate digestion of the peccant matter. The patient has a sudden and slight respite, which he falsely attributes to the last change of position. A gentle perspiration is succeeded by sleep. He wakes freer from pain, and finds the part recently swollen. Up to this time, the only visible swelling has been that of the veins of the affected joint. Next day (perhaps for the next two or three days), if the generation of the gouty matter have been abundant, the part affected is painful, getting worse towards evening and better towards morning. A few days after, the other foot swells, and suffers the same pains. The pain in the foot second attacked regulates the state of the one first attacked. The more it is violent in the one, the more perfect is the abatement of suffering and the return of strength in the other. Nevertheless, it brings on the same affliction here as it had brought on in the other foot, and that the same in intensity and duration. Sometimes, during the first days of the disease, the peccant matter is so exuberant, that one foot is insufficient for its discharge. It then attacks both, and that with equal violence. Generally, however, it takes the feet in succession. After it has attacked each foot the fits become irregular, both as to the time of their accession and duration. One thing, however, is constant—the pain increases at night and remits in the morning. Now a series of lesser fits like these constitute a true attack of gout—long or short, according to the age of the patient. To suppose that an attack two or three months in length is all one fit is erroneous. It is rather a series of minor fits. Of these the latter is milder than the former, so that the peccant matter is discharged by degrees, and recovery follows. In strong constitutions, when the previous attacks have been few, a fortnight is the length of an attack. With age and impaired habits gout may last two months.

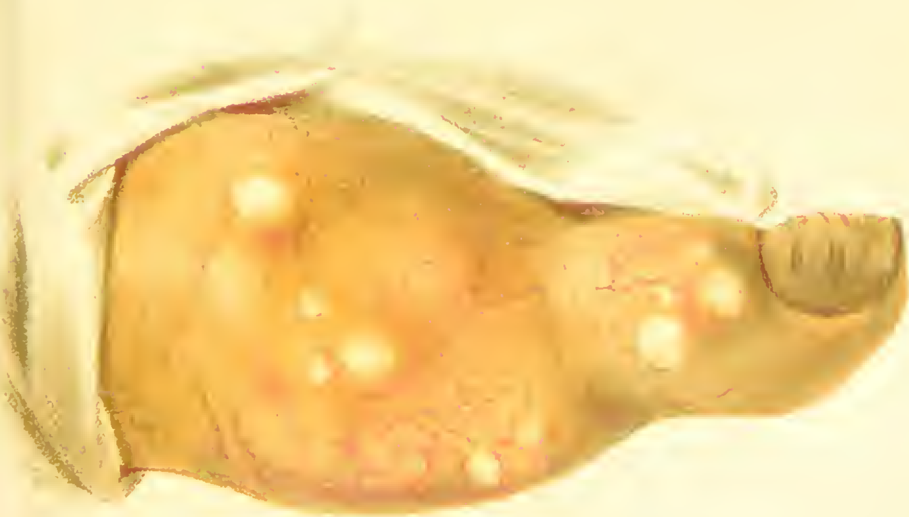
---

* From the translation of Sydenham's Works, by Dr. R. G. Latham.

With *very* advanced age, and in constitutions *very* much broken down by previous gout, the disease will hang on till the summer is far advanced. For the first fourteen days the urine is high-coloured, has a red sediment, and is loaded with gravel. Its amount is less than a third of what the patient drinks. During the same period the bowels are confined. Want of appetite, general chills towards evening, heaviness, and a troublesome feeling at the parts affected, attend the fit throughout. As the fit goes off, the foot itches intolerably, most between the toes; the cuticle scales off, and the feet desquamate, as if venomed. The disease being disposed of, the vigour and appetite of the patient return, and this in proportion to the violence of the last fits. In the same proportion the next fit either comes on or keeps off. Where one attack has been sharp, the next will take place that time next year—not earlier."







CHAPTER III.

CHRONIC GOUT:—NOT A CONSTANT SEQUEL TO THE ACUTE AFFECTION —DESCRIPTION OF—CONSTITUTIONAL SYMPTOMS—ALTERATIONS OF STRUCTURE PRODUCED BY CHRONIC GOUT—NATURE OF THE SO-CALLED CHALK-STONES OR TOPHACEOUS DEPOSITS—THEIR MICROSCOPIC AND CHEMICAL CHARACTERS—THEIR FREQUENT OCCURRENCE —SITUATION OF—UPON EARS—OFTEN USEFUL IN DIAGNOSIS—AROUND JOINTS—WITHIN BURSÆ—CAUSING MUCH DEFORMITY—ILLUSTRATIVE CASES—GOUTY ABSCESSES—MR. MOORE'S AND MR. HOWSHIP'S DESCRIPTION OF—CIRCUMSTANCES LEADING TO THE FORMATION OF EXTENSIVE CHALK-LIKE DEPOSITS—SYDENHAM'S DESCRIPTION OF CHRONIC GOUT.

THE boundary between acute and chronic gout is completely arbitrary; nevertheless, when the disease has made much inroad into the constitution, and its attacks have become frequent, the affection assumes a form to which the term Chronic Gout may properly be applied; and though it may not cause such excruciating suffering as the more rare and intense visitations of the acute disease, still, by its longer duration, or almost constant presence, it is apt to induce a depraved state of the whole system, and by leading to distortion and rigidity of the joints, the formation of chalk-stones and other sequelæ embitter the life of the sufferer to such an extent that, as Heberden forcibly remarks, "It can hardly be reckoned one of the disadvantages of the gout, that, after destroying all the comforts of living, by this weight of misery, or by bringing on a palsy or apoplexy, it immaturely extinguishes the powers of life." It must not, however, be assumed that gout always leads to such terrible results; for, when the constitution has been originally good, when little or no hereditary predisposition has existed, and no great depressing cause or improper treatment has subsequently induced a shattered condition of the system, instead of the attacks increasing in frequency, they may become more and more rare, and even after a lengthened period, little or no apparent injury may have resulted from them. A gentleman, who died a few years since, under my care, at the advanced age of eighty-four, had suffered from the disorder for more than half a century, but the upper extremities had been always exempt: no chalk stones, stiffness, or other deformities were visible; and during the latter part of his life the gouty fits were slight, and occurred at long intervals. Several other cases in which gout had lasted from thirty to forty years, without any appreciable amount of injury resulting, have come under my observation in practice. In the other and less favourable class of cases, the disease gradually becomes more frequent and irregular in its visitations; and, instead of occurring annually, or half-yearly, only a month or two may elapse between the attacks; and as these generally are more prolonged than in acute gout, a fresh fit will frequently ensue before the subsidence of the preceding one, and thus in some cases the patient is scarcely ever free, except during a few of the summer months. The joints are usually swollen to some degree from effusions into the bursæ or capsules, they are likewise stiffened and difficult to move; there may be no redness or increased heat of the parts, comparatively little pain, and an absence of febrile excitement, except perhaps a little at night, accompanying the increased pain which then generally occurs. Although there may be no fever, still other symptoms, which often precede and accompany the attacks of acute gout, are likely to be present in an exaggerated degree, such as muscular and nervous pains, often regarded as rheumatic, cramps, dyspepsia in all its varieties, evinced by acidity, heartburn, pyrosis, flatulence, weight and pain after food, palpitation of the heart, constipation, deficient or depraved secretion of bile, lowness of spirits, and so forth; after a time leading to great impairment of the general health, sallowness of the complexion, and emaciation. The urine, formerly of a high colour and throwing down copious sediments of urates on cooling, now assumes a much paler appearance, remains bright, is more copious, and, if deposits occasionally occur, it is only after a severe exacerbation. A trace of albumen is frequently present, especially where the joints are much inflamed and febrile disturbance exists, and the urine exhibits microscopic and chemical peculiarities, which will be more especially dwelt upon in a subsequent chapter.

Sometimes chronic gout is confined to one or two joints, sometimes numerous articulations are involved, and not unfrequently the disorder travels from one joint to another; occasionally it even leaves these parts and attacks other and more important organs. When limited to a few joints the disease is likely to produce permanent local mischief; when it assumes the erratic form, the serious effects described under Misplaced and Retrocedent Gout, are more prone to occur.

Chronic gout, indeed, seldom continues in one locality for any length of time without giving rise to some serious and permanent change of structure, the nature of which we will now describe. These alterations consist either in the production of partial, or even complete anchylosis of the joints, or the formation of the so-called chalk-stones around the articulations, or in other parts of the body.

Before, however, describing these modifications, it will be well to allude to the nature and composition of the white deposits, as their occurrence is completely pathognomonic of the disease, being never formed in any other malady than true or genuine gout. They are called chalk-stones, and hence the variety of the disease in which they are found is sometimes designated chalk-gout. Other names have been occasionally applied to these deposits, such as tophaceous concretions, or tophi, a word derived from the Hebrew, implying concretion. The word chalk-stone we shall find to be, strictly speaking, erroneous; it was first used when the deposited matter was supposed to be composed of chalk, or carbonate of lime; but we now know that no such compound exists in its composition, and that, in its pure state, it is devoid even of the presence of lime in any form. Although the older physicians were entirely ignorant of the true nature or composition of this chalk-like matter, their ideas as to its pathological relations were not so erroneous, as has been generally supposed. The ancient writers, together with Sydenham, and all the authors belonging to the school of humoral pathology, considered the matter to be, what they termed, undigested gouty matter, thrown out around the joints, which afterwards became hardened by the heat of the parts.

The consistence of these chalk-like deposits varies extremely; sometimes they are quite soft to the touch, at other times almost as hard as chalk itself. In order to demonstrate their true character, we will examine them carefully in both conditions. A little white spot is often observed upon the helix of the ears of patients suffering from chronic gout, and if such has been recently formed, it gives rise, when punctured with the point of a lancet, to the exit of a semifluid, cream-like exudation. This, covered with a film of glass, and placed under the microscope, exhibits the appearance seen in Plate 5, fig. 3, and consists of a clear fluid containing a great number of acicular, or needle-like crystals; exceedingly small, and requiring some considerable magnifying power, and good definition to show them distinctly. With these crystals, a few blood discs are frequently observed, arising from the slight injury to the skin; these are shown in Plate 6, fig. 5 *a*. If a little of the white exudation be heated with a few drops of dilute nitric acid upon a porcelain dish, and, when almost dry, exposed to the vapour of ammonia, a beautiful purple colour is produced from the formation of murexide, or purpurate of ammonia. If the white matter be dried and incinerated, a little ash is left, alkaline in reaction, and exhibiting all the reactions of soda. Under polarised light, the appearance of the crystals is such as is seen in fig. 7.

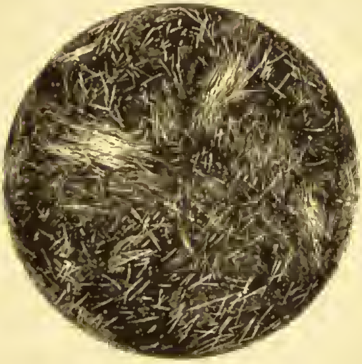


Fig. 7.*

The white matter is soluble to some extent in hot water, and its solution on cooling or evaporation, deposits needle-like crystals of urate of soda, usually arranged in balls or tufts (Plate 5, fig. 4). If a concretion in a semi-solid condition be examined, the same appearance is exhibited, except that the crystals are more aggregated together in little masses of needles, sometimes difficult to separate from each other; this, however, can be effected by putting a drop of water upon the slide, and then using a little pressure with the thin upper glass. When the concretion is quite solid, by crushing a small particle and treating it as before, with water, a similar appearance is observed. These white deposits are thus shown to consist essentially, and often entirely, of urate of soda; but, when embedded and hardened in any tissue, animal and earthy matters may become intimately united with them; these can be separated by treating the mass with hot water, which dissolves the urate of soda, but leaves the salts of lime, and animal matters. A small portion of the uric acid is now and then dissolved out, in combination with some potash or lime existing in the tissues, in the form of urates of these bases, but the amount of these salts is generally insignificant.

---

* Fig. 7. The appearance presented by a drop of the cream-like fluid obtained by puncturing a recently formed urate of soda deposit. That in the drawing was obtained from the knuckle of a patient whose case is described in the present chapter. Linear magnifying power 220, polarised light.

These deposits are probably thrown out at first in the form of a limpid fluid, but being rich in urate of soda, a very sparingly soluble salt, soon assume a milky appearance from crystallisation. The fluid portion is afterwards slowly absorbed, and thus the concretions gradually harden until they acquire a very firm consistence. Subsequent to the examination by Dr. Wollaston, in 1787, there have been several analyses of these concretions taken from different parts of the body; one, by Marchand, of a deposit over the femur, and close to the knee-joint, was found to consist of:—

Urate of soda	34·20
Urate of lime	2·12
Carbonate of ammonia	7·86
Chloride of sodium	14·12
Animal matter	32·53
Water	6·80
Loss	2·37
	100·00

Another analysis, by Lehmann, of a concretion from the metacarpus of a young man who had suffered from gout, was found to contain a great number of four-sided prisms of urate of soda, and when dried yielded the following results:—

Urate of soda	52·12
Urate of lime	1·25
Chloride of sodium	9·84
Phosphate of lime	4·32
Cellular tissue	28·49
Water, loss, &c.	3·98
	100·00

There are other analyses, such as those of Laugier, Wurzer, and L'Heretier, all of which closely agree with each other and prove that these deposits are rich in uric acid and soda, but contain besides, other substances in small quantities, as phosphate of lime, chloride of sodium, and organic matter. L'Heretier found a large per-centage of phosphate of lime, but gave no details concerning the situation of the concretion.

As I have before observed, there can be no doubt that the essential component in gouty deposits is urate of soda, which always assumes a crystalline form (I have never examined a deposit in which it did not do so); other matters are indeed often present, in varying quantities, derived from the tissue in which the deposition has taken place, but the large amount of phosphate of lime which is occasionally met with is probably derived from secondary deposition, from the urate of soda acting as a foreign body, and producing ordinary inflammation; and thus, as in the case of the formation of cretaceous tubercles in the lungs and elsewhere, giving rise to phosphatic exudation, which must be regarded, not as related to the disease as gout, but as the result of common inflammation only.

Partial or complete anchylosis, which is of rare occurrence in acute gout, frequently supervenes in the chronic forms of the affection. Sometimes there is no bulging or enlargement of the joint, or the appearance of any deposit; at others, it is accompanied with a moderate amount of swelling, and when this occurs in the hand, an appearance represented in fig. 8, (page 74) is produced.

In the hand from which the drawing was made, there was sufficient deposit to cause some bulging, and besides this, little white points could be seen here and there, especially about the palmar ends of the fingers, showing the close approach of the urate to the surface. When there is no enlargement, a very peculiar and angular form of distortion of some of the phalangeal joints often ensues; so characteristic, indeed, as to afford, to the practised eye, almost complete evidence of the nature of the disease producing it. This form will be again referred to when the varieties of the so-called Rheumatic Gout are treated of.

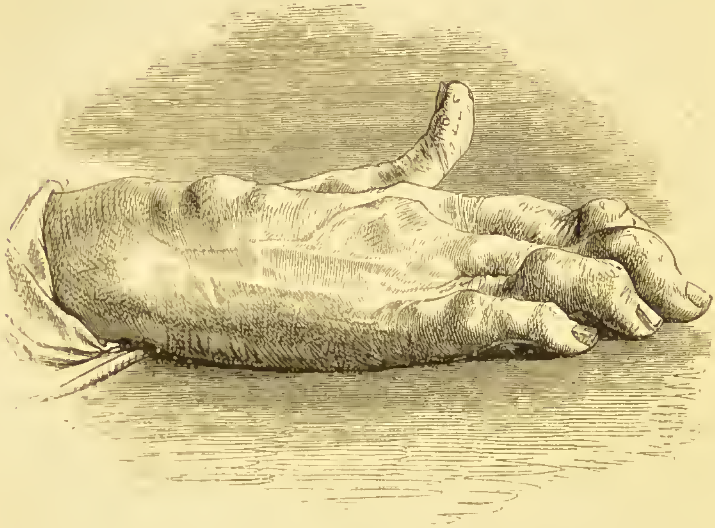


Fig. 8.*

Comparatively few gouty patients become the subjects of visible chalk-stones, at least to any extent, or such as to induce deformity; at the same time I am convinced that their occurrence in a slight degree is by no means so rare as has been generally assumed. Sir C. Scudamore stated that in five hundred cases of gout he only found them forty-five times, or in less than ten per cent. From my own experience I consider these numbers far below the real proportion, being confident that their existence is frequently overlooked, as they are sometimes deposited in parts of the body scarcely to be expected. In one or two works it is mentioned that small concretions are now and then seen even upon the cartilages of the ears, but no particular notice is taken of the fact. Within the last few years I have specially investigated this point, and find that instead of such deposits being occasionally present on the ear, they are more frequently found there than in any other situation;* and that where they are visible upon any other part, they are usually, but not invariably, seen on the ears also.

---

* Fig. 8, taken from a wax model, in the anatomical museum of University College, of the hand of a patient suffering from chronic gout of many years' duration, and represents a condition not unfrequently met with. A few white points are seen where the chalk-like matter has approached the surface.

In thirty-seven gouty patients who were examined to ascertain the presence or absence of concretions of urate of soda upon the surface, or in such situations as to be undoubtedly recognised, it was noted, that they were present in seventeen cases, absent in twenty; and in the above seventeen, they occurred in the ears alone in seven cases, in the ears and around the joints in nine, and in one case only could they be recognised in other parts of the body, without being present in the ears also.

In the ears they vary much both in number and size, sometimes only one exists, at others as many as eight or ten; in size they occasionally equal a split pea, often they are not larger than a pin's head, and now and then even much less, a mere point only. They have the appearance of little pearls, and are generally situated about the fold of the helix; sometimes they possess a gritty hardness, but often are soft, and when punctured give exit to a milky or cream-like fluid. Further examination shows that when hardened they become firmly attached to the cartilage of the ear, and enlarged blood-vessels are often seen in their neighbourhood, and extending some distance from them.

---

* Medico-Chirurgical Transactions, volume xxxvii., 1854.

In Plate 1, fig. 1, an ear is represented having but one of these points; it was the only evidence of chalk deposit which could be discovered throughout the whole body of this patient, who had neither stiffness nor deformity of any joint.

The following is an abstract from the history of his case.

1854.—J. E., aged forty-three, a gardener, with no hereditary predisposition to gout; has lived well, drank freely of porter, and now and then taken spirits. The first attack of gout came on when he was thirty-one years of age, and was confined to the ball of the great toe, lasting about a week; the second attack was likewise limited to the same joint, and occurred about a year after the first. The fits subsequently became more frequent, and the ankles, knees, and hands involved. About ten weeks before he came under my care he felt chilly and feverish, with pains in the head and oppression of the chest; the wrist inflamed, and the head was then relieved; about a fortnight after his recovery from this attack, which lasted a month, he had an affection of one of his ankles and great toe, which were swollen, painful, and very tender. On my seeing him, the toe was still tender, pitting somewhat on pressure, with signs of commencing desquamation of the cuticle. There were no chalk-stones observed around the joints, and no deformity or stiffness of any of the articulations which had been previously implicated; but at the upper part of the helix of the right ear a pearly white spot was seen about the size of a small millet seed. By appropriate treatment he was soon restored to his usual health.

Plate 1, fig. 2, also represents the ear of a gouty man; the disease in this latter case was much further advanced, and several other concretions were seen on different parts of his body.

A very condensed history of this patient is as follows:—

1855.—J. D. M., a man about fifty-eight years of age, not inheriting gout, has been engaged for many years in a cook-shop, and has lived well, taking much meat, and drinking pretty freely of porter and gin. For the last twenty-five years has suffered from gout, at first in one or other great toe, and at intervals of a year or two; but after a time the attacks increased in frequency, and many joints were affected. For more than twelve years he has noticed rigidity and distortion of some of his joints, especially of the hands, and numerous deposits, or chalk-stones, have formed, some of which have been discharged by ulceration. Upon both ears many little white points are seen, and the blood-vessels leading to them are distended; he also frequently notices that before a fit the ears become painful. During the time this patient has been under my observation, now many years, the appearance of the ears has greatly changed, a circumstance arising from the detachment of some of the little nodules, and the formation of new ones; when recent they are quite liquid, exhibiting a beautiful crystalline appearance under the microscope, and yielding murexide with nitric acid and ammonia. The blood of this patient has been examined two or three times, and found loaded with urate of soda; the urine is slightly albuminous during a severe attack, but not in the intervals: its analysis is given in a subsequent chapter.

I have seen several patients with ears much more extensively affected than the above, both as regards the number and size of the deposits. One gouty gentleman at Vichy, who was undergoing a course of the waters, exhibited a beautiful row of from ten to twelve beads, like large pearls, arranged along the edge of the helix of one ear. After a time these concretions becoming hard, are apt to be rubbed or picked off; and several instances, in addition to the one just quoted, have come under my notice, in which the appearance of the organ has varied considerably at different periods. The presence of such deposits in this situation is deserving of attention, as it may prove of considerable service in the diagnosis of doubtful cases. I may observe that when I have found them absent in the ear, at the time that they were present elsewhere, it has been in individuals in whom this organ was usually warm, which we know to be rather exceptional. Patients with these auricular appendages not uncommonly feel some pricking and pain in their ears prior to and at the commencement of an acute gouty attack. I have occasionally found these deposits occur in the ear shortly after an attack of gout. In one case, of which I have notes, the ears were carefully examined without result when the patient left the hospital, but within ten days, on a re-examination, one was present; perhaps during the fit some of the fluid may have been effused, but being at first transparent could not be easily distinguished.

Gouty concretions are commonly situated upon the hands and feet, but the upper extremities are more usually affected than the lower. At the present time, July, 1858, a gentleman is under my care whose case well illustrates the early development of these deposits. He is about 63 or 64 years of age, looks healthy, and is in good plight; has suffered from gouty attacks during the last twenty-five years; at first they were confined to the great toes, they then gradually affected the feet, ankles, and knees; but latterly the hands have been also involved. This gentleman had an attack in the spring of the present year, which was more lengthened than usual, and he afterwards observed that some of the articulations of the fingers remained slightly crippled; in this condition he first applied to me. The last phalangeal joints of two or three fingers were stiffened, partially anchylosed, and a little swollen; but on the dorsal surface of the second phalangeal joints of three fingers small rounded protuberances were observed, the skin over them being rather red; these bulgings appeared somewhat soft, as if containing a thick fluid, but not the slightest indication of white matter could be seen through the skin; they might have been either gouty concretions in their early stage of formation, or some other form of swelling. From simply seeing them I could form no opinion as to their true nature; but from the history of the case I was convinced that they arose from a deposit of urate of soda. Upon puncturing one of the little swellings, full light was thrown upon the case; for a fluid of a creamy consistence immediately exuded, a drop of which placed under the microscope, with the use of polarised light, gave the appearance represented in fig. 7, (page 70), which was drawn from the slide in which some of this fluid was preserved. The crystals were proved by analysis to be prisms of urate of soda.

These swellings, as they increase in size and become more solid, approach the surface; the skin becomes thinner, and the peculiar white appearance is then seen, which at once reveals their character, as observed in the great toe (Plate 1, fig. 3), and in the ears, before referred to. The account of the man from whose toe the drawing was made is shortly this:—

1854.—T. C., aged 57. A house painter for forty-three years. Has lived well and drunk freely.

His general health had been good till within the last twelve years, when he fell from a scaffold and shortly afterwards had lead colic. Gout then commenced in the great toe, and the attacks have of late years much increased, both in severity and frequency; and on the ears, and around numerous joints of the body besides the delineated toe, many white urate deposits are visible, some of considerable size.

Joints around which tophi, or chalk stones, have formed, become distorted in proportion to their number and extent, until at last the most fearful crippling ensues; such, for example, as is represented in the hand in Plate 2.

This unfortunate patient, J. E., about the time that the drawing was made of his arm and hand, was sixty-seven years of age; since his boyhood he had lived as a servant in different families. At the age of thirty-six, he had his first attack of gout in the great toe, and afterwards at intervals was similarly afflicted; when about the age of fifty-three or fifty-four, tumours began to form on the fingers and elbows, and after a time, about the joints of the feet; these swellings from their first appearance gradually increased in size. A year since, a fluid of the consistence and colour of cream was discharged from one of the tumours, and two or three others have since suppurated; in general they are not painful, but become so on change of temperature, and especially in damp weather. The movements of the elbow-joint are not much interfered with, but those of the hands greatly impeded. The tumours on the hands and elbows are considerably larger than those on the feet and knees. The patient's mother, grandmother, and brother, appear to have been affected with gout, but in a less degree. I have in my possession a chalk-stone taken afterwards from this patient, which in a recent state weighed more than two ounces avoirdupois.

These exaggerated forms are not very commonly met with, although within the last ten years I have seen at least three patients with hands almost as much disfigured as that shown in the drawing.

When speaking of the morbid anatomy of gout, we shall enter more fully into the deeper situations of these concretions, and of the structures which they commonly involve.

The bursæ mucosæ are very liable to become inflamed during an attack of gout, and after the acute inflammatory action has passed off, may remain distended; this distention arises from a fluid having been secreted in their cavities, a fluid which often gives rise to a deposition of solid matter, and hence results the formation of permanent chalk-stones. The bursa over the olecranon process of the elbow-joint is peculiarly prone to be thus distended, and, in many cases, we find its walls thickened and a little hard nodule felt in the interior; sometimes, from repeated attacks, it becomes enormously distended, as is well seen in Plate 2. When no solid matter can be felt through the walls of these enlarged bursæ, they will occasionally, if punctured with a fine instrument, give rise to a fluid exudation, having the crystalline characters already described. The following case, which recently occurred in my practice, well illustrates this fact:—

1858.—W. F. A man, aged sixty-one, has had gout for fourteen years. The first, as also several of the subsequent attacks, were confined to the ball of the great toe of right foot; the left great toe then became affected, and afterwards the elbows. No deposits of gouty matter were anywhere visible; but the bursa over left olecranon process was enlarged and prominent: the walls were thickened, and felt somewhat elastic; the skin over it was also red. The patient had suffered very recently from an acute attack in one of the great toes. Feeling somewhat doubtful as to the character of the fluid within the sac, it was carefully punctured, and nearly half a drachm of a white matter exuded, which exhibited the characteristic crystalline appearance we have so often referred to, due to the presence of innumerable prisms of urate of soda.

The bursæ about the knee-joints are liable to distension, and permanent enlargement may remain from the deposition of gouty matter. I have now under my care (October, 1858) a patient who exhibits this deformity, and likewise a remarkable distortion of one finger from a like cause, which is represented in fig. 9. (page 84).

The history of the case and his present condition is as follows:—

J. B., a man aged forty-three, by trade a plumber, having no known hereditary predisposition to gout; temperate in his habits, but accustomed to take about two pints of porter a day; has suffered severely from gout for twelve or fourteen years, chiefly in spring and autumn. The first attack, which affected the great toe, occurred as far back as twenty years; after this he had a respite of some duration. About ten years since, the disease made its appearance in a more general form, many other joints, besides the great toe, being implicated; from this time the disorder became frequent in its

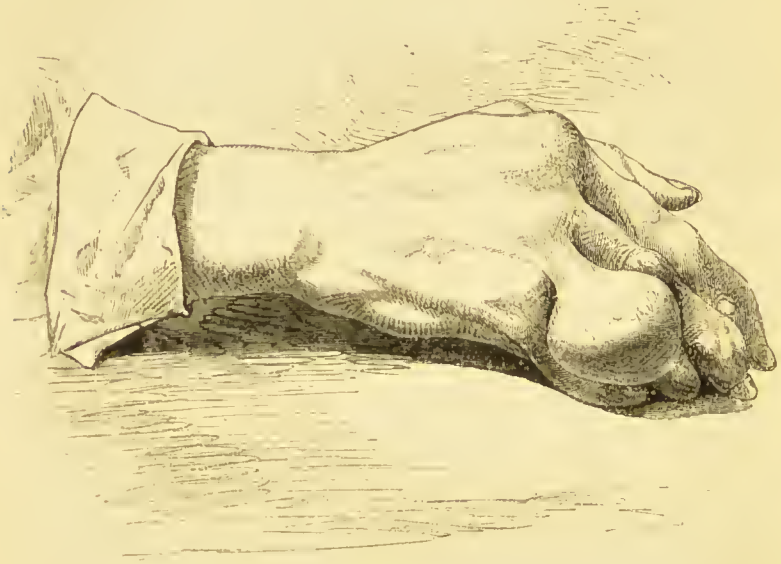


Fig. 9.*.

---

* A drawing of the hand of a patient in University College Hospital, in which the first phalangeal joint of the third finger of right hand is shown extremely enlarged from the deposition of urate of soda around it.

visitations, and serious in character. About five years ago, he noticed enlargement of the first phalangeal joint of the third finger of the left hand, apparently induced by running a piece of glass into it; but subsequent to this, deposits appeared in many other situations. When the patient came under my care the following notes of his condition were taken:—a distinct blue line is seen on the free margin of the gums, which, as well as the lips and surface, are somewhat emaciated; he has never had lead colic. Upon the helix of the right ear two small white spots are observed and deposits can be distinctly felt in the bursa over the left elbow; both hands are much deformed, many of the phalangeal joints are anchylosed, and here and there the deposits approach so near the surface as to resemble white patches. It is around the first phalangeal joint of the third finger of the right hand that the most marked deformity is observed, for it is swollen almost to the size of a small hen's egg, its long diameter being transverse, and overlapping the fingers on each side, as shown in the engraving, fig. 9. The skin of the tumour is somewhat red, tense, and shining; the blood-vessels distended, with a sensation to the touch of being composed partly of solid, partly of semi-fluid matter. It has been increasing for many years, and consists of urate of soda of different degrees of consistency. Both ankles and right foot are enlarged, but not edematous; on several of the toes little white points are seen, from which gouty matter has formerly exuded; the bursa over the patella of the left knee is much enlarged and bulging, with several white spots where the chalky deposit has approached the surface, and from which some has occasionally been discharged. The urine is pale in colour and rather abundant; its average specific gravity 1010, and, during an attack of recent gout, slightly albuminous, exhibiting casts both of granular and waxy tubes.

Not uncommonly, and especially among workmen who are accustomed to use their hands in grasping tools, white deposits are seen on the palmar surface of the ends of some of the fingers, on account of the matter which was originally deep-seated becoming more superficial from constant friction.

Sometimes small nodules of urate of soda are found upon the eyelids, especially the lower, now and then in the integuments of the face.* Dr. H. Barker has seen one on the side of the nose, the size of a horse-bean; and in one instance I observed a true gouty deposit as large as a split-pea, apparently attached to the fibrous structure of the corpus cavernosum of the penis.

---

* With regard to the white-looking deposits which often occur about the eyelids and the integuments of the face, I may remark that some care is necessary before deciding upon their nature, as they are seen in subjects who have never had gout, and even in gouty patients, and still not connected with the disease, merely consisting of epidermic scales mixed with fatty matter and cholesterine. I have recently examined two white deposits from the same individual, a martyr to gout; one taken from the helix of the ear, the other from the under eyelid. That from the ear was crystalline and consisted of urate of soda; that from the eyelid was simply sebaceous.

After patients have suffered from these concretions for a length of time it is not uncommon to find that the skin over them becomes thin, and fragments of the chalk-like matter thrown off, occasioning very little annoyance. Sometimes, the concretions, acting as foreign substances, set up considerable inflammatory action, accompanied with suppuration, and by this means ulceration is induced, which often proves difficult to heal; when such is the case, the discharged matter consists of small masses of urate of soda mixed with a considerable number of pus globules. (Plate 6, fig. 3, and fig. 5, *b*.) A very interesting and valuable paper on gouty concretions is contained in the first volume of the Medico-Chirurgical Transactions, 1809, by Mr. James Moore, Surgeon to the Second Regiment of Life-Guards. In this communication the mode of formation and progress of these tumours is so graphically described that I have been induced to transcribe a portion. After a few preliminary remarks as to the nature of chalk-stones, he goes on to state:—"This effusion (meaning the milky fluid containing the urate of soda) occurs not only during fits of gout, but likewise in the intervals; and as the extremities, particularly the hands and feet, are the principal seat of gout, it is there the greatest accumulation of chalk takes place. Though this process is usually preceded and accompanied by inflammation, the chalk is never inclosed in a cyst, like pus in an abscess. It lies usually in the cellular membrane, in the bursæ mucosæ, or in the cavities of the joints. I have even seen it thrown out between the cutis and the cuticle. But, as the gouty inflammation is of the erythematous kind, there is no extravasation of coagulable lymph, and no new-formed covering surrounding the chalk. This point is of the first importance, and explains many of the peculiarities of gout, which is generally considered as a phlegmon. But the absence of coagulable lymph in the inflamed parts I consider as full evidence of the inflammation being erythematous.

"The chalky liquid when first secreted gives to the finger the feeling of fluctuation, and cannot be distinguished from the ordinary serous effusion of gout. But unfortunately the absorbents cannot suck up the chalky particles. The consistence of the liquid, therefore, becomes thicker and thicker, till at last nothing remains but a hard mass. When even a considerable effusion of this kind occurs, the quantity of chalk which ultimately remains is comparatively small, as by far the greater quantity is merely serum. It therefore usually requires repeated effusions to form any great mass of chalk, and the consistency depends upon its age, and the activity of the absorbents. The quantity at last accumulated by repeated paroxysms is in some instances immense, which augments very seriously the sufferings of the gouty. The distress, however, is not owing to any irritating quality in the chalk, but to its obstructing the motion of the tendons and joints, occasioning often complete anchylosis, and pressing and distending the surrounding parts by its bulk. It acts, therefore, by mechanically embarrassing the machine of the body, and not upon the living principle; for it will often remain for years in parts highly sensible without exciting the slightest pain or inflammation. Although these concretions are of so mild a nature, they often are the cause of extensive mischief, bursting externally, occasioning ulcers very difficult to heal. When a violent fit of the gout attacks a chalky tumour, the appearance is frequently very alarming, the new paroxysm being accompanied with a fresh serous and chalky effusion, which, added to the old deposit of chalk, occasions a prodigious swelling; the cutis when distended to the utmost opens, yet sometimes the cuticle remains entire. The chalky or serous liquid may then be seen through the semi-transparent epidermis. The surrounding integuments appear of a deep red, or of a purple hue, threatening mortification; while the pain is excruciating.

"At length the cuticle gives way, a discharge of serum and chalk takes place, and a remission of all the symptoms usually follows. During the whole of this alarming process suppuration never occurs; but soon after the opening has taken place suppuration commences, and pus and chalk are then discharged from the ulcer. There are several unexpected occurrences in the progress of such ulcerations. When an opening is formed, the whole of the chalk never escapes, and its complete evacuation is often a very tedious process; this is owing to its being diffused through the cellular membrane, as in the cells of a sponge. One cell must sometimes give way after another, and small portions of chalk are successively thrown out; so that months and even years pass away before the whole is discharged. It also frequently happens that the orifice contracts and closes over, leaving portions of chalk underneath. This kind of cicatrix sometimes stands its ground, but more commonly breaks out again and again to discharge chalk. Even openings into joints, which are so dangerous when occasioned by other extraneous bodies, are often attended with no serious symptoms when the joint is filled with chalk. On such an accident happening, a surgeon unacquainted with these peculiarities might be tempted to propose large openings or even amputation, as the only resource for hindering extensive inflammation and carious bones. But if he treats the disease mildly, he will find that no such severe plans are requisite, for the parts will probably fall into a very tranquil or indolent state; a sore will continue for a certain period, discharging pus and occasionally a bit of chalk, till at last the orifice will close up. Independent of the openings formed by a fit of the gout, the skin, stretched over a mass of chalk, is sometimes thinned, absorbed, and pierced by mere pressure. At other times this is effected by common inflammation and suppuration. When openings take place in these milder ways, a less quantity of chalk is usually evacuated: but this depends entirely upon the degree of inflammation. When the suppuration is great, it naturally detaches and washes out a greater quantity of chalk.

"The last peculiarity is the rarest, namely, that a dry hard piece of chalk shall pierce the skin, and remain like an excrescence, without exciting either inflammation or suppuration."

The point upon which I should feel disposed to differ most from Mr. Moore, is with regard to the non-occurrence of suppuration prior to the opening of the skin; this is certainly not invariably the case, for I have seen many abscesses formed around gouty nodules, which have at once given exits to a large amount of pus, as well as urate of soda, on being punctured; this has generally occurred in patients in a very weak state of health.

It not uncommonly happens, that when patients are suffering from gouty abscesses, which are keeping up a constant discharge of such matter, they enjoy a comparative immunity from other symptoms, and I have more than once known, the healing of these abscesses followed by a sharp attack of gout in some other part of the body, as if the ulcers had acted as a species of safety-valve. Before terminating this part of our subject I will give the details of an interesting case furnished by Mr. Howship to Sir C. Scudamore, as it illustrates well the formation and course of a severe gouty abscess:—

"A female, aged forty-three, had for many years suffered severely from gout. The attacks of the disease, at first confined to the first joint of the great toe, subsequently affected the articulations of the fingers, the wrists, and the heels; ultimately the hands were almost covered with tumours, the action of the joints of the fingers being all either much impeded, or quite destroyed by the repeated effusions of chalky matter.

"For the space of three or four years the disorder manifested itself principally by very extensive, painful, and tedious inflammation of the heel, which ulcerated and threw out a copious and long-continued secretion of chalky as well as purulent matter; and no sooner was the one heel recovered, than the other became affected in the same way.

"In 1815, this patient, still confined to her bed, and totally helpless from the inflamed and ulcerated state of the heel of the left leg, experienced a very smart attack of erysipelatous inflammation upon the right leg, and when this began to give way, violent inflammation took place lower down at the ball of the great toe. The integuments covering the joint soon sloughed out, and exposed a deep ulcerating surface. A little dry lint covered with a warm poultice, was the only application made to the parts which were examined daily. About a fortnight after the separation of the slough, some white matter made its appearance at the bottom of the ulcer, and was removed with the dressings. A few days after this, a mass of soft chalky substance, as large as a pea was seen, and was turned out with the end of a probe. In the course of a week, I observed that the same appearance had again taken place, and that the chalky secretion was deposited in exactly the same part of the ulcer as before; and it seemed to be deeper seated than the surface of the head of the metatarsal bone. I therefore made a particular examination with a probe, and thus ascertained that part of the surface of the bone was removed; the margin of the opening being readily felt all round among the granulations. Within this space there was a depression answering to the form of each of the small masses of chalk that had been previously removed. The ulcer even within the cancellated texture of the bone looked tolerably well, it was covered with granulations and secreted healthy pus.

"This peculiar secretion continued for some time; a fresh deposit of compact chalky substance being protruded, and removed from the ulcerated space within the bone, every few days for several weeks. At the termination of this period, the action lost its specific character, and the wound healed."

Some patients appear remarkably prone to the formation of gouty concretions, but others, even after a considerable number of fits, remain entirely free; this remark, it must be remembered, only applies to deposits of urate of soda around the articulations; for all such sufferers, as I shall presently prove, have alterations within the joints. Although it is much more common to observe the deformities produced by this disorder among men, yet females are by no means exempt, and I have had under my care two ladies exhibiting this form of the affection in a very high degree. In one case both the upper and lower extremities were stiffened and distorted by the bulging of nearly all the smaller joints, and the patient, who was about forty-three years of age, had become completely crippled within three years of the first attack of the disease. In the second case the deformity was much less marked, although the hands were nodulated and rendered almost useless.

The late Mr. Samuel Cooper, in his edition of Dr. Mason Good's work on Medicine, relates a similar instance he had seen in a lady not more than thirty years of age, at the Fleet prison, who was in such a state from deposits around the joints, that her limbs were of little or no use to her, and when her knees were bent and extended, a rattling noise was produced like that which would arise from shaking a bag of marbles.

The excessive formation of tophaceous deposits can be sometimes traced to debilitating causes: a severe shock upon the nervous system, sudden reduction in circumstances, leading to a comparatively impoverished living, and so forth.

A case, apparantly arising from the latter causes, came under my care some years since: —

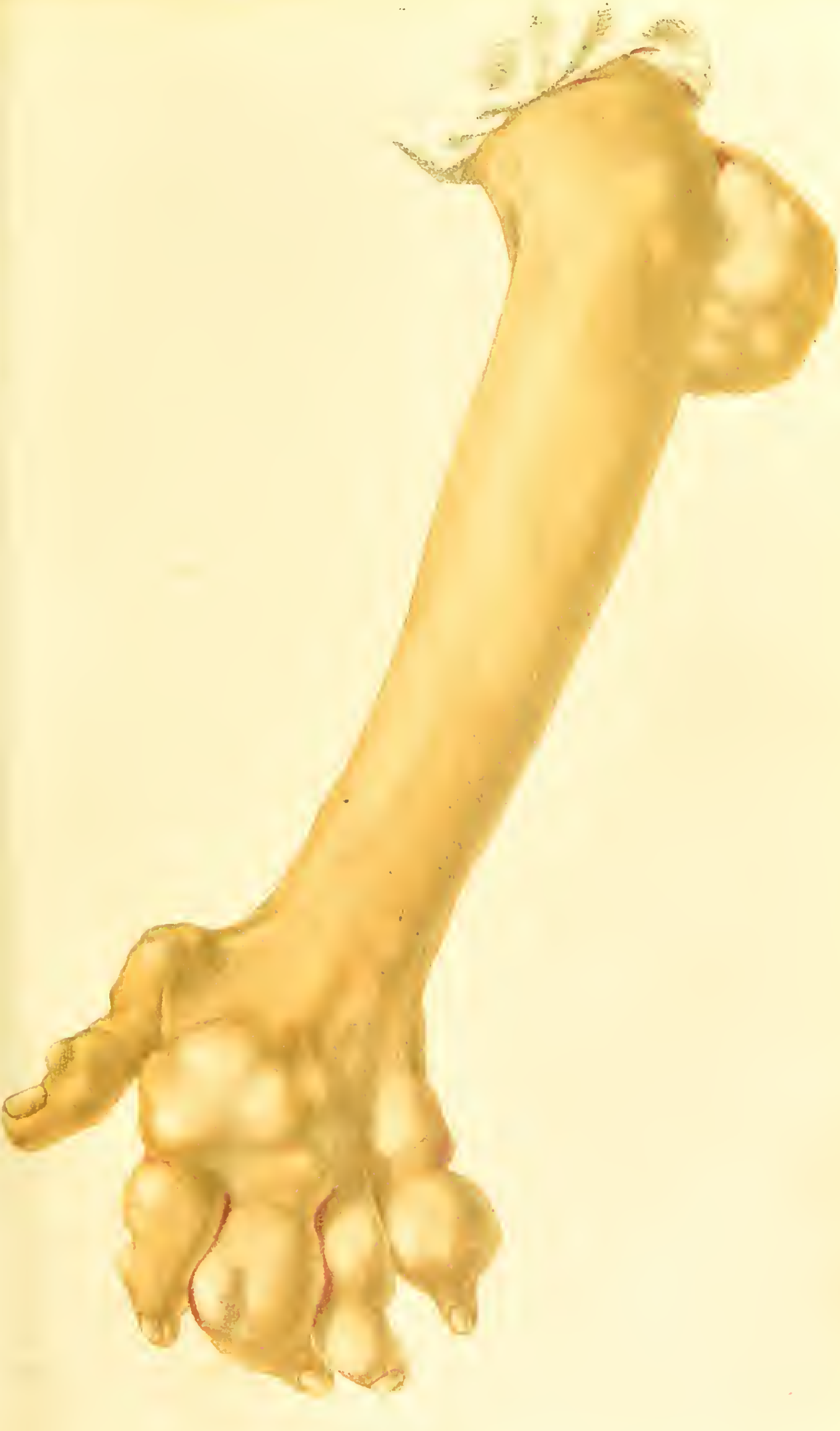
1851.—W. B., a man aged fifty-one, with no hereditary predisposition to gout, when about sixteen years of age went to service as steward's-room boy, afterwards became postilion, and was accustomed to drink as stablemen usually do; he was often out on the box all night, exposed to wet and cold. In 1826 he went to the Mediterranean, and travelled through France, Italy, and Switzerland, in the capacity of gentleman's coachman, and partook freely of the new wines of the countries, and also of brandy. He returned to England in 1830, quite well, but had suffered from some brain affection when abroad from exposure to the sun. Shortly after this he experienced fits in the August of each year, which were considered to be epileptic, and these obliged him to discontinue service, and thus to live very sparingly. The fits continued until 1845, when they terminated upon the occurrence of gout in the ball of the right great toe. The first paroxysm lasted about ten days, and he had no return for a year, when both feet were affected; the attacks after this rapidly increased in frequency and severity, and the hands, elbows, and knees became implicated. As early as after the first seizure in the upper extremities, he noticed some white spots in the tip of the right little finger, and soon afterwards numerous deposits took place around almost all the smaller joints of the hands, and many of the feet, and nodules were also seen on the ears. At last he became completely crippled, and much deformed, some of the deposits growing to a large size, and causing ulceration of the skin, and abscesses in different parts. The urine was very pale, with a slight trace of albumen, and scarcely any uric acid could be separated from it.

It frequently happens that no depressing cause can be shown to have acted in the production of these deposits, and sometimes they occur in patients whose constitutions are in other respects exceedingly good. A gentleman occasionally consults me, now about eighty-seven years of age, having both hands and feet extensively enlarged from deposits, many of which have formed abscesses constantly discharging urate of soda. In this case the constitution must have been remarkably strong, and I am not aware that any depressing cause has ever been in operation.

Another case in which the gouty enlargements were excessive, the hands of the patient being almost as much deformed as that represented in Plate 2, came recently under my care:—

1857.—The gentleman was sixty-one years of age, and had no hereditary predisposition to gout. In early life he lived freely, partaking chiefly of malt liquors with some spirits and water. Has had a very large family, all of whom are healthy. The first fit of gout came on about thirty years since, in the ball of the left great toe; then, in future attacks, the instep and ankle were affected. He thinks there was only an interval of half a year between the first and second visitations, but several years elapsed before the gout attacked the knees, and still longer before any of the joints of the upper extremities became implicated. For the last ten years has noticed chalk stones, and is now extremely deformed and crippled by them; all the joints of the hands are completely studded, and so are both elbows.

The feet are also distorted; large masses are seen



on the inner side of the left tarsus, from which fragments of white matter have been discharged; and there is much thickening around each heel.

Both ears are studded, and some of the nodules are of considerable size; they are also seen near the inner canthus of each eye.

He complains of few uncomfortable symptoms, other than acidity and heartburn, but north winds, or indulgence in wine or ale, are very apt to induce fresh inflammation about some of the crippled joints.

He remembers that his urine was formerly accustomed to give rise to a red sediment, causing a fur upon the vessel, but of late years (the last six or seven) it has become much paler and completely free from deposit; at present it is of low specific gravity, containing a distinct trace of albumen, but yielding scarcely any uric acid.

Injuries are now and then the apparent cause of the formation of tophi, but of course they act simply in localising them. I once saw a large chalky concretion on the back of the hand, the only one which could be discovered, and which the patient attributed to a blow he had received in a scuffle.

Sydenham's account of the progress of chronic gout, and of the sufferings and deformities produced by it, is equally correct and graphic with his delineation of the acute fit, and I cannot, in concluding this chapter, do otherwise than bring it before my readers in his own emphatic words:—

"When either undue treatment or the prolonged delay of the disease has converted the whole body into a focus for the peccant matter, and when nature is incompetent to its elimination, its course is different.

"The true seat of the disease is the foot, so much so, that when it appears elsewhere its character is changed, or else the constitution is weak. Then, however, it attacks the hands, wrists, elbows, knees, and other parts, the pains being as the pains of the feet. Sometimes it distorts the fingers, then they look like a bunch of parsnips, and become stiffened and immovable. This is from the deposit of chalk-stone concretions about the ligaments of the knuckles. The effect of these is to destroy the skin and cuticle. Then you have chalk-stones like crab's eyes exposed to view, and you may turn them out with a needle. Sometimes the morbific matter fixes on the elbows, and raises a whitish tumour, almost as large as an egg; which gradually grows red and inflamed. Sometimes the thigh feels as if a weight were attached to it, without, however, any notable pain. It descends, however, to the knee, and then the pain is intense. It checks all motion, nails the patient down to his bed, and will hardly allow him to change his posture a hair's-breadth. Whenever, on account of the restlessness so usual in the disease, or from any urgent necessity, the patient has to be moved, the greatest caution is necessary. The least contrary movement causes pain, which is tolerable only in proportion as it is momentary. This movement is one of the great troubles in gout; since with perfect quiet, the agony is just tolerable.

"Up to a certain time, the gout comes on towards the end of winter, lasts for two or three months, and retires regularly. Afterwards, however, it lasts throughout the whole year, except only the hottest months of the summer. Furthermore, the longer the attack, in general, the longer is each individual fit. Instead of a day or two, they last a fortnight. Instead of the feet, they attack any joint indifferently. Lastly, on the first or second day after, the patient, besides the pain, has loss of appetite and general discomfort."

CHAPTER IV.

BLOOD IN GOUT:—ALTERED CONDITION OF THE BLOOD IN GOUT OFTEN ASSUMED BY THE OLDER WRITERS, NOT PROVED UNTIL VERY RECENTLY—COMPOSITION OF THE BLOOD IN HEALTH—ITS ALTERATION IN GOUT—GLOBULES—FIBRIN—ALBUMEN—DISCOVERY OF URATE OF SODA IN THE BLOOD—MODE OF SEPARATING URIC ACID AND URATE OF SODA FROM IT—CLINICAL METHOD FOR DETERMINING THE PRESENCE OF URIC ACID IN THE BLOOD—DETAILS AND PRECAUTIONS—DELICACY OF THE TEST—READY DECOMPOSITION OF URIC ACID IN THE BLOOD—PROBABLE CHANGES WHICH ENSUE—TABLE CONTAINING A SHORT SUMMARY OF CASES OF GOUT IN WHICH URIC ACID WAS PROVED TO EXIST IN THE BLOOD—DISCOVERY OF URIC ACID IN FLUIDS ARTIFICIALLY EFFUSED—USE IN DIAGNOSIS—SMALL AMOUNT OF UREA IN THE BLOOD IN GOUT, ALSO OF OXALIC ACID—TRACES OF URIC ACID AND UREA IN HEALTHY BLOOD—PERSPIRATION IN GOUT—OXALIC ACID FOUND IN THIS SECRETION.

IN vain shall we seek for satisfactory information respecting the alterations of the blood in gout among ancient writers, or even those of modern date; for until recently all that had been advanced, though embodying much truth, was of a purely speculative character, and failed to convince the minds of many distinguished physicians, who endeavoured to account for the phenomena of the malady, by other than the hypothesis of the presence of a morbific matter.

In this chapter it will be my aim to give an account of the present state of knowledge on this subject, of the highest importance for the right understanding of the pathology of gout, and for the clear explanation of many of the symptoms it exhibits, which are altogether pathognomonic of the disease.

If any one portion of the body may be considered of paramount importance, it is undoubtedly the blood, for through its agency all the changes attending the phenomena of life are accomplished; through its means the different portions of the animal frame are nourished, and it is in itself the centre of the most important changes. Hence the value of a careful study of its composition and properties in the investigation of the nature of any disease.

As the blood receives all the crude nourishment introduced into the system, previously to its becoming a part of the solid framework, and prepares such for its destination; as it is also the receiver of the products of the metamorphoses of the tissues; there will necessarily be found among its constituents matters ready to be prepared and made fit for nutrition; principles already perfected; and besides these, various effete matters destined for excretion. These latter exist in the blood, in health, in the most minute traces, on account of the perfection and activity of the excreting organs.

Physical Characters of the Blood.—When circulating in the vessels or freshly drawn from them, the blood of the higher animals is of a bright red colour, more florid in the arteries than the veins, and of a somewhat thick and viscid consistence. On examination it is found to consist of a transparent yellowish liquid, the liquor sanguinis, in which numerous red globules are contained, together with a few larger and colourless corpuscles. The more numerous and important discs are named the blood-globules, and under the microscope are found to be bi-concave and varying in size from $\frac{1}{3200}$ to $\frac{1}{3500}$ inch, and in thickness they are about one-fourth of their diameter.

Within a few minutes of being drawn from the body, a change takes place in the blood, an exhalation (ammonia*) is emitted, a film appears on the surface, commencing at the circumference, and very shortly afterwards the whole becomes a gelatinous mass. In from fifteen to twenty minutes a shrinking of the solid portion occurs, separating it from the sides of the vessel, and a clear fluid exudes; this continues some hours, and the blood is thus resolved into two parts, called clot and serum. If this change be observed in very thin layers, under the microscope, the red globules are seen to arrange themselves in rouleaux, forming meshes, and after a time very fine fibres are perceived, stretching across the spaces formed by these rouleaux, apparently attached to the blood-globules, and giving the appearance of a fine net-work. The explanation of the phenomenon is as follows. The liquor sanguinis contains a small amount of a principle called fibrin, which when removed from the blood-vessels possesses the property of spontaneous coagulability, and during its coagulation, consisting as this does, in the formation of the numberless minute fibres just described, entangles the red corpuscles within its meshes and thus forms the clot. The clot, therefore, contains the red corpuscles, plus the fibrin, the serum, the liquor sanguinis, minus the fibrin.

---

* Dr. Richardson has recently shown that the coagulation of the blood is accompanied with a liberation of ammonia.

The globules, when chemically examined, can be shown to consist of at least two proximate principles: one, colourless, named globulin; the other, the red colouring matter, hæmatin, which is peculiar in containing a large amount of iron.

The serum is a watery solution of albumen, but with many other substances dissolved in it; the most important of these are saline matters, as the tribasic phosphate of soda and chloride of sodium, with traces of principles destined for excretion. This fluid has a pale yellow or straw colour, a distinct alkaline reaction, and a density about 1029, subject however to certain small fluctuations within the limits of health. It is in this portion of the blood that we discover the presence of abnormal ingredients, as also the increase of the various excrementitial matters.

The composition of healthy blood in the 1000 parts is seen in the annexed table:—

Water		784·
Oxygen Carbonic acid Nitrogen	dissolved in the fluid.	

Globulin	123·5	constituting the red corpuscles	131·
Hæmatin	70·5		
Fibrin			2·2
Albumen			70·
Salts:			
Phosphate of soda, lime, magnesia, and iron			6·
Sulphate of potash			
Chlorides of sodium and potassium, silica, &c.			
Fats:			
Margarine			1·3
Oleine			
Seroline			
Cholesterine			
Phosphureted Fats, &c.			
Unknown substances, called extractive matters, with traces of urea, uric acid, creatine, &c.			5·5

We have now to inquire what changes take place in the blood in gout. Do the normal constituents become altered in character? or are matters naturally excrementitious retained in the fluid, thus influencing its composition?

The *globules*, we may state, are by no means necessarily altered in this disease; for in the acute affection in otherwise healthy individuals they remain in the normal proportion; but in many chronic and asthenic cases they are notably diminished, as they would likewise be in weakened and depraved conditions of the habit arising from any other cause. In gout occurring in painters, plumbers, and other workers in lead, it is common to find considerable diminution of the globules; this is not the effect of gout, but dependent on the metallic impregnation; as one of the earliest symptoms which arises from the absorption of lead, is the production of an anæmic condition of the system.

The *fibrin* in gout appears to undergo the same variations as in other inflammatory diseases. When a patient is suffering from considerable local inflammation it becomes increased in quantity, even to four, five, or six parts in 1000, the augmentation being in proportion to the intensity of the inflammation; but in chronic gout this principle may remain in about its normal proportion, or only very slightly raised. The variation in the fibrin appears, therefore, to have no relation to gout as such, but depends simply on the development of inflammation from the morbid condition of the habit. The blood when drawn from a gouty patient may exhibit the phenomena of being buffed, or even buffed and cupped, or it may present nothing abnormal.

The *serum* of the blood in gout is not necessarily altered in physical characters; its specific gravity may remain at the normal figure, and its colour and consistence as in health. Still, from the results of an extensive table showing the weight of this fluid in different diseases, I am of opinion that in gouty cases the mean specific gravity is lower than in most other affections; in fact than in all other diseases, with the exception of albuminuria and true scorbutus. In many cases of acute gout occurring in robust men, the blood does not show this phenomenon; and I have no doubt it only occurs in patients who have suffered from the disease for a long time, accompanied with defective nutrition, or in cases of well-marked kidney affection. When treating of the condition of the urine in gout, we shall show how common it is to find, at least traces of, albumen in the acute forms, and still more frequently in the chronic disease, especially when accompanied with visible deposits of urate of soda. The diminution of the specific gravity in these cases depends upon the loss of albumen by the kidneys; in scarcely any case of gout have I observed the weight of the serum below 1025; the average in chronic cases has been from 1027 to 1028, a little lower than in health. I have never found the albumen of the blood increased in gout, although such has been occasionally assumed on mere hypothetical considerations. The variations in amount of the saline matters of the serum in gout have not yet been made a subject of special investigation, which remark equally applies to the fatty ingredients.

Where, then, shall we discover the morbid changes of this fluid in gout, seeing the normal constituents are not necessarily modified? It is in the augmentation of those principles which exist in health in such minute traces as to be detected with difficulty, that the peculiar alteration of the blood in this disease is manifested.

A severe case of gout came under my notice in University College Hospital, in the summer of 1847. The patient was a man about 41 years of age, who had for the three previous years suffered from repeated fits of this disease, and exhibited several small chalk-stones about the palmar surfaces of his fingers, and a few spots in the ears. At the time of admission into the hospital, he was labouring under a recent acute attack, and many joints in the right hand were inflamed and swollen. From several considerations I was induced to examine his blood, and more especially with the object of ascertaining whether or not uric acid was present; for this purpose, through the kindness of Dr. C. J. B. Williams, under whose care the patient was placed, a small amount of the fluid was procured. The clot was found to be firm and somewhat buffed: the serum clear, alkaline in reaction, and of specific gravity 1028. Feeling assured that, if uric acid were present, it would be in the serum, 1000 grains of that fluid were dried in a water bath, reduced to powder, and boiled with rectified spirit, for the purpose of removing matters which might interfere with the separation of the uric acid, and after being thus exhausted it was treated with boiling distilled water.

When a few drops of the watery solution were evaporated almost to dryness with nitric acid, and held over the vapour of ammonia, distinct evidence of uric acid was afforded by the production of the beautiful purple tint of murexide or purpurate of ammonia; and when reduced to a thin syrupy consistence, and a few drops of hydrochloric acid added, and set aside, in a few hours crystals of uric acid were deposited with the characteristic forms of that body.

From another quantity of blood drawn soon after the first, 1000 grains of serum were taken and treated in the same manner, except that no hydrochloric acid was added. The concentrated watery solution was allowed to stand for some hours, when on examination, very numerous tufts of crystals were found deposited on the sides of the vessel and surface of the fluid. These crystals were proved to consist of urate of soda; they yielded rhombs of uric acid on the addition of a stronger acid, and when incinerated left an ash, alkaline in reaction, soluble in water, and not answering to the tests for potash.

These observations were soon repeated upon several cases of gout with uniform results, and published in the Transactions of the Medico-Chirurgical Society for 1848; and the following conclusion was at that time drawn, viz., that "the blood in gout always contains uric acid in the form of urate of soda, which salt can be obtained from it in a crystalline state." From this time up to the present, a space of more than eleven years, I have been in the habit of examining the blood in this disease when opportunity has presented itself, now in at least a hundred cases, and the only alteration I should be disposed to make in the above would be to append the words, "in abnormal quantities;" as I have found that in health the merest traces both of uric acid and urea can usually be detected by very great care in manipulation.

The results of several quantitative analyses which I made on the blood of gouty patients, in order to determine the amount of uric acid, are contained in the paper alluded to.

In the case of the man whose history is recorded, and in whose blood uric acid was first discovered, 1000 grains of the serum yielded 0·050 grain of uric acid.

In a second case the same quantity of serum gave 0·025 grain of uric acid.

In a third case 0·030 grain of uric acid was obtained from 1000 grains of serum.

In the blood of a fourth patient 1000 grains of serum yielded as much as 0·175 grain of uric acid.

In another case whose history has been detailed in the chapter on chronic gout, from 1000 grains of serum of blood 0·11 grain of uric acid was obtained.

In these determinations, the quantities obtained were doubtless much under those really present, for considerable loss, arising from several causes, is apt to ensue.

The process for determining uric acid above described requires considerable time and care, especially if any attempt be made at determining the quantity; and hence, although it is a method most desirable to have recourse to in investigating the pathology of gout, yet it is one which cannot be readily employed in clinical medicine. To obviate this difficulty I have devised another mode of ascertaining the presence of uric acid in the blood, which I have now been much in the habit of using clinically for the last eight years, and with the results of which I have reason to be well satisfied; it is likewise a method which can be readily employed by every medical practitioner, and which has the advantage of requiring the abstraction of only a very small quantity of blood. I have named the process, the "Uric Acid Thread Experiment," and it is thus performed:—Take from one to two fluid-drachms of the serum of blood, and put it into a flattened glass dish or capsule; those I prefer are about three inches in diameter, and one third of an inch in depth, which can be readily procured at any glass-house; to this add ordinary strong acetic acid, in the proportion of six minims to each fluid-drachm of serum, which usually causes the evolution of a few bubbles of gas. When the fluids are well mixed, introduce a very fine thread, consisting of from one to three ultimate fibres, about an inch in length, from a piece of unwashed huckaback or other linen fabric, which should be depressed by means of a small rod, as a probe or point of a pencil. The glass should then be put aside in a moderately warm place, until the serum is quite set and almost dry; the mantel-piece in a room of the ordinary temperature, or a book-case, answers very well, the time varying from twenty-four to forty-eight hours, depending on the warmth and dryness of the atmosphere.

Should uric acid be present in the serum in quantities above a certain small amount noticed below, it will crystallise, and during its crystallisation will be attracted to the thread, and assume forms not unlike that presented by sugar-candy upon a string, as shown in Plate v., fig. 5, *a*, *b*, *c*; when in the dark field under polarised light it has an appearance represented in the woodcut, fig. 10. To observe this, the glass containing the dried serum should be placed under a linear magnifying power of about fifty or sixty, procured with an inch object-glass and low eye-piece, or a single lens of one-sixth of an inch focus answers perfectly. The uric acid is found in the form of rhombs, the size of the crystals varying with the rapidity with which the drying of the serum has been effected, and the quantity of uric acid in the blood. To ensure perfect success, several precautions are necessary.

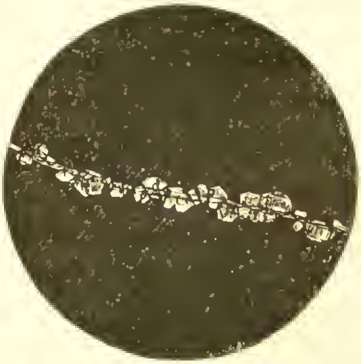


Fig. 10.*

1. The glasses should be broad and flat; watch-glasses of the ordinary kind are not suitable, being too small, allowing the fluid to be frequently spilt, and also too much curved, causing the film of partially dried serum to curl up and split.

---

* Fig. 10 represents a fibre of threads with rhombs of uric acid adhering to it, as seen under polarised light with a linear magnifying power of 60, formed with an inch object-glass and low eye-piece.

2. The acetic acid should be neither very strong nor weak. The glacial acid often forms a gelatinous compound with the albumen of the serum, producing flakes; and very weak acid adds unnecessarily to the bulk of the fluid. By experience I find the ordinary strong acetic acid (about $\frac{30}{100}$) well suited for the experiment.

3. The character of thread and its quality are of some moment. Very smooth substances, as hairs or fine wire, but imperfectly attract the crystals; if the number or length of the fibres be too great, and the amount of uric acid small, the crystals become much scattered, and therefore but few appear in the field of the microscope. The glass should not be disturbed during the drying of the serum, or the crystals may become detached from the thread.

4. Some attention to temperature is necessary; if the serum be evaporated at a high temperature, above 75° Fahrenheit for example, the drying may take place too rapidly to allow crystallisation; the temperature of an ordinary sitting-room answers well for the purpose; it should be protected from dust.

5. If the serum be allowed to dry too much before the examination takes place, the surface becomes covered with a white efflorescence consisting of feathery phosphates which may obscure the thread, and which are represented in Plate vi., fig. 4, *c*; they can be removed by the addition of a few drops of water before placing the glass under the microscope; sometimes over-drying causes the film to become cracked or

fissured throughout, as well as covered with the phosphatic efflorescence.

6. It is well, when practicable, to put up two or more glasses with the same serum.

7. The blood should be recently drawn, or at least no change or decomposition should be allowed to take place in it before the experiment is made, for uric acid when in contact with animal principles is liable to undergo decomposition, as we shall subsequently have occasion to show.

Degree of delicacy of the above Test for Uric Acid.—The serum of healthy blood, as also that of patients suffering from most diseases, although generally containing a trace of uric acid, gives no indication of its presence by the "uric acid thread experiment;" and this absence of extreme delicacy is of itself a most valuable quality. I have endeavoured to ascertain, by a series of experiments, the quantities of uric acid which must exist in blood before its presence can be thus demonstrated,[*] and for this purpose have added urate of soda, in certain definite proportions, to the serum of blood taken from a healthy subject, and in which the most careful chemical analysis could scarcely detect the existence of a trace.

1. Serum, with the addition of uric acid in the proportion of 0·010 grain in the 1000 grains . . .	gave no indication of uric acid.
2. Serum, containing 0·020 grain in the 1000 grains	no crystals of uric acid deposited.

---

[*] Medico-Chirurgical Transactions, vol. xxxvii.

3. Serum, containing 0·025 grain in the 1000 grains	gave two or three crystals on thread.
4. Serum, containing 0·030 grain in the 1000 grains	gave a few crystals.
5. Serum, containing 0·040 grain in the 1000 grains	gave several crystals.
6. Serum, containing 0·050 grain in the 1000 grains	a moderate sprinkling of crystals on the thread.
7. Serum, containing 0·060 grain in the 1000 grains	the thread pretty freely covered with crystals.
8. Serum, containing 0·080 grain in the 1000 grains	very numerous crystals on thread.
9. Serum, containing 0·100 grain in the 1000 grains	abundance of crystals, more than usually found in serum.
10. Serum, containing 0·200 grain in the 1000 grains	thread completely covered with uric acid, and numerous crystals scattered throughout serum.

From this it appears, that an amount of uric acid equal to at least 0·025 grain in the 1000 grains of serum, in addition to the trace existing in health, is required before the "thread experiment" gives indication of its presence, and hence the appearance of uric acid on the thread is complete evidence of an abnormal or morbid quantity in the blood. In several experiments on the blood in gout and albuminuria, where quantitative determinations were made, the amount of uric acid in the 1000 grains of serum was found to vary from 0·045 to 0·175 grain.

Changes in the Uric Acid during Decomposition of the Serum.—In enumerating the precautions which should be observed in the employment of this test, it was stated that recently drawn blood should be made use of; and the importance of this precaution will be seen from the following observations, which were at first the cause of some perplexity. Having ascertained the presence of uric acid in the blood in several cases, and put aside the serum for a time, I found, on repeating the experiment, that no indication of uric acid could be discovered; this happened most frequently during the summer months. On closer examination I ascertained that the serum had undergone slight decomposition; this gave me a clue to the explanation of the phenomenon, namely, that the uric acid in the blood undergoes a species of fermentation, and is decomposed whenever the albuminous portion becomes altered. In order to verify this, the following experiment was made and repeated several times with uniform result.

Urate of soda was dissolved in serum in the proportion of from 0·10 grain to 0·30 grain to the 1000 grains, and the fluid allowed to become putrid; small portions being put into the glasses from time to time; it was found that the crystals, although very numerous at first, became fewer in number and soon disappeared altogether, proving the uric acid to have been gradually destroyed; and thus showing the extreme importance of using fresh serum, more especially in warm weather.

I have made some experiments in order to discover the changes which uric acid undergoes when subjected to such decomposition.

It is a well-known fact that when exposed to the action of certain oxidising agents, as puce coloured or per-oxide of lead, uric acid is broken up into oxalic acid, urea, and allantoin, and when the oxide is in excess the oxalic acid is further oxidised and converted into carbonic acid; this fact led me to try whether oxalic acid may not be formed in the blood from a change in the uric acid. For this purpose I made daily observations on serum rich in urates during its decomposition, and found evidence of the formation of oxalic acid, in the occurrence of octahedral crystals of oxalate of lime. After a time these crystals appeared less numerous, and at last altogether vanished. I have also evaporated the serum when decomposition was taking place, and treated the residue as above described, and many crystals of oxalate of lime were thus obtained, for the most part in octahedrons, some agglomerated into oval bodies, some similar to dumb-bells. To make the experiment more conclusive, I have taken the serum of blood not containing an appreciable amount of uric acid, divided it into two parts, to one portion have added urate of soda in small quantities, and allowed both to decompose; it was found that in the portion of serum to which the urate had been added, octahedral crystals of oxalate of lime were formed, but not in that portion free from uric acid. The microscopic examinations were made with amplifying powers of 200 to 400 linear. Much further investigation into this subject is required, but enough has been done to show that the study of these changes is not without interest to the pathologist; for there can be little doubt that oxalic acid is formed in the animal body, not, as formerly supposed, from the oxidation of saccharine matters, but from the decomposition of uric acid.

As before stated, I have made very numerous determinations of the blood in cases of gout; in the subjoined table some account of forty-seven of these will be found, and a perusal of them will leave no doubt in the mind of the reader that the articular affection under which the patients suffered was truly characteristic. Since the table was constructed, I have made many further examinations, all confirming the results therein contained; but those already tabulated are abundantly sufficient to prove my original statement that the blood in gout is rich in uric acid.

It will be observed that the history and symptoms exhibited by the patients coincide exactly with those we have already recorded in our account of acute and chronic gout, and they equally agree with what we shall have to relate in a future part of this volume.

Thus, two only of the forty-seven were females; all were adults, generally about the middle age; in many the hereditary tendency was marked, and in the rest the habits were such as strongly to predispose to the disease. The ball of the great toe was ascertained to be specially affected in a very large per-centage; edema was frequent after the inflammation had subsided; chalk-stones were present in a considerable number; and lastly, there was in all the absence of acute cardiac affection.

TABLE, *Exhibiting the History and Symptoms of* 47 *Cases of Blood.*

Name.	Age.	Occupation.	Habits of Life	Hereditary Predisposition	General state of Health.	No. of attacks.
W. F.	38	Gas-fitter, occasionally musician. Has never had lead colic.	Drank much gin and beer or porter.	Father had gout or rheumatism. Mother's father gout, and all mother's brothers. Also own brother. (See below.)	Pretty good. Fractured ribs about six years ago; since then affected with present disease.	Numerous. Four or five well marked.
F. P.	43	Painter (House.)	Drank freely, porter and gin. Not in great excess; often six pints of porter daily.	Apparently hereditary from father, who, however, died when patient was young.	Good, except when suffering from gout or lead colic.	Numerous. First attack eleven years since, first in ankle, next in great toe.
J. E.	64	Stonemason.	Not stated.	Not stated.	Good.	Numerous. First attack occurred twenty years since in some part of foot.
W. F.	40	Wine-cooper.	Has drunk freely of beer and gin.	Father and grandfather on same side had gout, and father had chalkstones.	Pretty good.	Numerous. First about ten years since, in feet and ankles.
C. F.	38	Brewer's Man.	Has drunk very freely, chiefly porter; some gin.	Father's brother had gout.	Good, in general.	Not known; numerous. About ten years since had first attack, confined to foot.
C. F.	35	Painter.	Temperate; about two	See under W.F., case 1,	Pretty good, except from	Second attack. First,

Articular Affection, in which Uric Acid was present in the Cases of genuine Gout.

Cause of.	Symptoms during Attack.	State of Blood.
Much drinking before present attack.	Commenced in ball of left great toe; after four or five days, knees, elbows, hands, fingers, and left ankle, also left metacarpal and phalangeal joints affected. Pitting on pressure. Pulse 92, hard and full; tongue slightly furred; some thirst; deposits of urate of soda on palmar surface of left index finger. Not on ears.	Clot firm; serum alkaline; sp. gr. 1029·4 at 68° F.; much uric acid by thread experiments.
None assigned for the present.	Commenced in left knee, then dorsum of left hand, right hand, and both feet and ankles, small joints of hands. Pitting on pressure. Pulse 92, rather hard; tongue slightly furred; appetite pretty good. Deposits in both ears. No other deposits seen. No permanent mischief to joints.	Clot slightly buffed and contracted; serum alkaline; sp. gr. 1028·0 at 60° F.; abundance of uric acid. *Blister fluid* from inflamed joint; no trace of uric acid. *Blister fluid* from abdomen gave a moderate amount of uric acid.
Not stated.	Affection of hands, ankles, knees, hips. Pulse 80. Deposits in ears; and little nodules in integuments near eyes.	Uric acid in serum.
Patient has often brought on attacks by the use of port wine.	Commenced in knee, then elbow, and small joints of hands. Pitting on pressure. Pulse 76. No deposits of urate of soda noticed.	Serum contained a considerable quantity of uric acid.
None assigned.	Both feet, knees, hips, small joints of hands, and in great toe. Pitting on pressure. Pulse 80. No thirst. Minute concretions of urate of soda in left ear. Large semi-fluid collection in left foot of creamy urate of soda; some deposit also on right little finger.	Clot firm; buffed and cupped; serum alkaline; sp. gr. 1029·0 at 55° F.; abundance of uric acid. *Blister fluid* from inflamed part, gave no trace of uric acid. *Blister fluid* from ankle, a few crystals of uric acid.
Injury. Struck by	Commenced two days after injury, in left elbow and fingers; after-	Clot normal; serum alkaline; sp. gr. 1026·8

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
			pints of porter daily; formerly took spirits also.	the brother of the present patient.	present disease.	one year and a quarter since, commenced in left foot.
T. B.	54	Farrier.	Has always been a free drinker of beer and gin.	Father had gout, also one brother.	Good.	Has had numerous attacks. First in feet, seven or eight years since; does not remember whether the great toe was chiefly affected; great toes have been in some attacks.
J. H.	45	Publican for many years, formerly a post-boy.	Intemperate. Drank much beer and gin. Good diet.	Father had gout, also brothers.	Good, except gouty.	Numerous. First, about fourteen years since, in right great toe.
S. N.	68	Wheelwright.	Regular.	Not known. (Patient very deaf indeed.)	Pretty good.	About the twelfth. First attack in ball of left great toe, next in right great toe, afterwards in large joints also.
J. Z. R.	48	Stableman, formerly a soldier.	Lived freely, both in eating and drinking.	None.	Good.	About third attack. Twenty years since, swelling of ball of great toe; next attack

Cause of.	Symptoms during Attack.	State of Blood.
a shaft; and fracture of ribs and pleuritis.	wards both feet and right knee, and right index finger. Pitting on pressure. Pulse 108. Tongue furred; thirst. Fluid from right index finger (middle joint) obtained by puncture, milky from urate of soda (four days after it was inflamed); concretions afterwards appeared on right ear, and in left middle finger.	at 50° F.; abundance of uric acid. *Blister fluid* from chest, a moderate amount of uric acid.
Injury from the kick of a horse, on chest.	About forty-eight hours after injury, the dorsum of right hand and foot, and left elbow, upon which he fell became affected. Pitting on pressure. Pulse 80, full, hard; some thirst; appetite good. No deposits of urates.	Clot slightly buffed; serum alkaline; sp. gr. 1026·64 at 58° F. A good sprinkling of uric acid on thread.
Drink.	Ankles and feet chiefly affected. Pitting freely on pressure. One knee also much swollen; tongue clean; appetite good; no thirst. Pulse 76, not resisting. Nodules of urate of soda on both ears.	Clot normal; serum alkaline; sp. gr. 1029·6 at 47° F. Abundance of uric acid by thread experiment.
Not given.	Great toes both affected; left knee slightly; patient has eczema of both legs. Pulse 92. Appetite good. No deposits of urate of soda.	Clot normal; serum alkaline; sp. gr. 1026·0 at 65° F. Considerable sprinkling of uric acid on thread.
Not assigned.	Commenced in right knee, then hip, shoulders, hands, left knee, balls of both great toes became implicated. Pulse 110, rather hard; tongue white, furred. Pitting on pressure. No deposits of urate of soda on any part of body.	Clot normal; serum alkaline; sp. gr. 1028·0 at 60° F. A few crystals of uric acid. *Blister fluid* gave crystals of uric acid. *Blister fluid* from inflamed knee, no crystals of uric acid.

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
						commenced also in great toe.
G. H.	56	Traveller.	Temperate, but has drank much porter; half a gallon or more per diem.	Not known.	Good.	About sixth attack. First confined to right great toe, ten years since. Other joints afterwards affected.
G. H.	52	Cab-driver and proprietor.		No gout or rheumatism from father or mother; but uncles and aunts on both sides subject to gout.	Good, except gout.	Numerous. First attack thirty years ago, in feet; second attack in ball of both great toes. Knees not affected until two years since; and last year upper extremities.
J. S.	61	Pianoforte-maker.	Lived well; drank moderately of beer and some gin.	None.	Good, except occasional gout, and latterly some albuminuria.	First attack of gout about twenty years since.
C. H.	46	Coachman. Last three	Has drunk freely of	None.	Good, except subject to	Numerous. First attack

Cause of.	Symptoms during Attack.	State of Blood.
		Second bleeding two days after: Clot not buffed or cupped; serum alkaline; sp. gr. 1027·1 at 65° F. Pretty good quantity of uric acid. Third bleeding eight days after: Clot firm; fibrinous coat; serum gave a moderate amount of uric acid by uric acid thread experiment.
Was exposed much to cold before present attack.	Commenced in right foot, then left foot, right knee, and hand; left shoulder and hand. Pitting on pressure. Pulse 108, hard; tongue white, furred. No deposits of urates.	Serum gave abundance of uric acid.
None assigned.	Affection of left elbow, wrist, and metacarpal joint of index finger. No deposits of urates. Pulse 86; tongue furred; no appetite. Pitting on pressure.	Clot buffed, firm; serum alkaline; sp. gr. 1025·56 at 64° F. Pretty good sprinkling of uric acid by thread experiment.
Present attack came on after some chest affection.	First examination of blood some little time before the joints became affected. Patient then suffering from chest symptoms and slight edema. Second examination after attack had completely passed off. During attack the right great toe and knee were affected. Pitting on pressure. Had albuminuria, gradually lessening to a mere trace.	First examination: Clot normal; serum alkaline; sp. gr. 1021·6 at 66° F. A good quantity of uric acid; thread studded with crystals. Second examination: Clot normal; serum alkaline; sp. gr. 1022·4 at 66° F. A very few crystals of uric acid.
None assigned.	Commenced thirteen weeks before admission, then partially recovered;	First examination: Clot firm, buffed; se-

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
		years a cabman.	beer and gin.		attacks like the present.	about twenty years since in right great toe and instep only. Second attack, sixteen years since, in same part. Third, twelve years since in left great toe. In subsequent attacks knees and elbows. Attacks gradually increasing in frequency.
J. B.	60	Excavator.	Drinks freely.	None.	Good.	Fourth attack. First, commenced in right great toe.
F. W.	47	Gentleman's servant.	Lived pretty freely. Drank beer chiefly.	None clearly discoverable.	Pretty good, except from gout.	Numerous. Early attacks commenced in great toe.
J. Q.	58	Has been for a long time a brewer's drayman.	Drank very freely of beer and gin.	None distinctly discoverable.	Pretty good until the last few years.	Numerous.
M. C.	60	Tradesman.	Drank freely, beer, &c.	Not known.	Good, until gout appeared.	Very numerous indeed.

Cause of.	Symptoms during Attack.	State of Blood.
	for three weeks has kept his bed. Hands, knuckles, knees, feet, and shoulders affected. Pulse 72, full, hard. No deposits of urate of soda. The first examination of the blood was made during febrile disturbance of the system; the second when the patient had pain in joints, but no fever.	rum ; sp. gr. 1026·0 at 66° F. No uric acid found by thread experiment. Second examination : Clot normal ; serum alkaline ; sp. gr. 1024·8 at 65° F. A moderate amount of uric acid.
Appears to have had attacks every one or two years.	Dorsum of left wrist, hand, metacarpal and several phalangeal joints, and swelling of right side of face. Pitting of parts on pressure. Pulse 72. No deposits of urate of soda in any part of body.	Clot buffed, firm ; serum clear, alkaline ; uric acid thread experiment gave abundance of uric acid.
Cold. Taking hard beer.	Pains of fingers, wrist, elbow, and shoulder of left side; then same on right side; left great toe, right knee. Pulse 104, rather full and sharp. Some thirst, moderate appetite. Pitting on pressure. Desquamation of cuticle. No deposits of urate of soda.	Serum ; gave by uric acid thread experiment uric acid on thread ; serum of blood from loins by cupping gave also the same.
Drink brings on an attack.	Left hand and arm, and knees slightly affected. Pulse 80. Pitting on pressure. Several small deposits of urate of soda in ears ; and much distortion of small joints of feet and hands.	Clot not buffed ; serum clear, alkaline ; sp. gr. 1027·5 at 54° F.; uric acid thread experiment gave much uric acid on thread. About 0·07 grain collected by analysis from 1000 grains of serum.
The present attack seemed to be brought on by mental anxiety.	Present attack chiefly in head; delirium, heat of head, &c. Many of the smaller joints of feet and hands much distorted. No distinct deposits of urates.	Blood by cupping from loins ; clot firm ; serum clear ; sp. gr. 1029·2 at 70° F. ; uric acid thread experiment gave abundance of uric acid.

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
T. M. April, 1854.	53	Cook.	Eats freely of meat; has drunk pretty frecly of beer. Not intemperate.	None known.	Good, except when gouty.	Almost innumerable. First commenced in right great toe about twenty years since. For some time the disease attacked great tocs only.
Idem. Feb. 1850.						
Idem, Nov. 1849.						
G. R.	31	Cabman for many years.	Drinks freely of beer, some spirits.	None.	Good before present affection.	About six; has had joint affection without fever.
W. M.	52	Printer.	Before having gout, drank rather freely of gin, some beer; lived well.	None known; but one younger brother has gout.	Good until fourteen years since.	Very numerous. First attack in right great toe, about twelve years since. Second attack a year after, in great toe also. Upper extremities have not been affected for more

Cause of.	Symptoms during Attack.	State of Blood.
None assigned for any one attack.	This patient has had at different times all the joints of the body acutely inflamed, sometimes the larger, sometimes the smaller, chiefly affected in the attack. There is always much pitting on pressure. The pulse during acute attacks, becomes quick and hard. Nodules of urate of soda on both ears; and chalk stones on many parts of body, both upper and lower extremities. Sometimes discharges of this urate, and formation of abscesses take place.	Clot buffed, and slightly cupped; serum clear, alkaline; sp. gr. 1027·12 at 60° F. By uric acid thread experiment a considerable amount of uric acid was obtained.
		Blood by cupping from loins; serum clear, alkaline; sp. gr. 1026·0 at 53° F. Uric acid thread experiment gave abundance of uric acid.
		Clot firm and large; serum clear, alkaline; sp. gr. 1029·1 at 50° F. By uric acid thread experiment an abundance of uric acid; from 1000 grains 0·04 grain collected.
	No swelling of joints. Symptoms subjective only. Appetite good. No thirst. Pulse 70. Complains of pains in joints, and stiffness in walking, which he has had several months.	Clot not buffed, not very firm; serum alkaline; sp. gr. 1027·4 at 63° F. A moderate amount of uric acid.
Not assigned for any one attack.	At various times, different joints affected, sometimes nearly all together. Great toes, and smaller joints of fingers, as well as large joints. Patient covered with concretions of urate of soda; many in ears; much crippled.	March, 1853.—Acute attack; clot cupped and buffed; serum alkaline; sp. gr. 1026·4 at 51° F. Abundance of uric acid, shown by uric acid thread experiment. *Blister fluid* gave uric acid. Vomited matters produced by colchicum gave no uric acid. July, 1852. — Acute attack; clot firm, buffed; serum alkaline; sp. gr. 1026·0. Gave uric acid

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
						than six years, nor concretions visible more than three years.
H. U.	50	Painter.	Irregular.	None known.	Good until he had painter's colic.	Numerous. First attack about three or four years since, in feet.
J. T.	42	Ginger-beer maker.	Takes beer freely, sometimes a little gin, but not intemperate.	None.	Pretty good, except gout.	Numerous. First attack about ten years since; very frequent within last five years. Not noticed in history which joint was affected in first attack.
W. B.	52	Coachman in gentlemen's families for many years.	Drank pretty freely at one time, chiefly wine.	None known.	Good, until first attack of gout.	Very numerous, had suffered for many years. Came on first in great toe.
T. M.	41	Porter; formerly in the army.	Regular.	None.	Pretty good, had some injury from poisoned wound, a few years since.	Third attack.

Cause of.	Symptoms during Attack.	State of Blood.
		in abundance on thread. Jan. 1851. — Acute attack. Abundance of uric acid in blood.
Attack clearly induced by drink.	Present attack chiefly affects joints of hands; but knees and feet stiff and painful. Concretions in ears and around some joints.	Blood serum contains abundance of uric acid.
A glass of rum will induce an attack. Over fatigue appeared to have brought on the present.	Commenced in hands; then knees, ankles, &c., became affected. Deposits of urate of soda in ears only.	Clot large and firm, buffed; serum alkaline; sp. gr. 1027·2 at 60° F. 1000 grs. of serum gave 0·044 grain of uric acid.
Any depressing cause, or drink, will induce a fresh attack.	Scarcely ever free from some acute affection in one or more joints. Concretions in hands, feet, elbows, &c., and ears. Gouty abscesses generally discharging more or less creamy urate of soda.	Clot normal; serum alkaline; sp. gr. 1030·0 at 60° F. 1000 grains of serum gave of uric acid 0·11 grain.
Not known.	Commenced at midnight, in the ball of left great toe. Pulse 100, rather hard. Tongue furred. Appetite pretty good. Afterwards desquamation of skin over ball of toe. No deposits of urates on any part of body.	Clot normal; serum alkaline: sp. gr. 1026·0 at 70° F. Abundance of uric acid by thread experiment. Second bleeding, attack passed off; clot normal; serum alkaline; sp. gr. 1024·0 at 53° F. A few crystals of uric acid. After leaving hospital; clot normal; serum pale; sp. gr. 1027 at 60°F. A few crystals of uric acid.

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
W. R.	32	House painter.	Diet good; not intemperate, but drinks beer.	Father had gout, brother suffers also from gout.	Repeatedly had lead colic. Gout for six or seven years; commenced in ball of great toe.	Numerous. For seven months has not been free from gout.
W. B.	46	Coal porter.	Good living; a considerable amount of porter per diem.	Father affected with gout.	Good.	First attack. Re-attack about three weeks after. Second attack.
J. D.	27	Farrier.	Regular. Diet good; takes a considerable quantity of beer, and some gin.	None.	Good.	First attack.
J. C.	30	House painter for ten years, before a plumber.	Irregular; has drunk much porter and spirits.	One grandfather, and father subject to gout.	Not good, from frequent syphilitic affections, gout and painter's colic.	Ninth or tenth attack. First commenced in great toe.
B. F.	38	Bricklayer.	Pretty regular, but drinks freely of gin and beer.	None.	Good.	Fifth or sixth. First, two years since, commenced in great toe.
H. C.	51	Grocer.	Regular.	Not known. Not noticed in case books.	Suffers from bronchitis and emphysema, and from occasional attacks of gout.	Numerous.

Cause of.	Symptoms during Attack.	State of Blood.
Subject to exposure to cold.	Right foot, great toe, both ankles, knees, right wrist, middle finger of left hand inflamed. Tongue clean. No thirst. Appetite good. Pulse 95. Much pitting of swollen joints. No deposits visible on any part of body. No distortion of joints.	Clot rather cupped; serum alkaline; sp. gr. 1028·0 at 41° F. Abundance of uric acid by thread experiment. *Blister serum*, on partial recovery yielded a moderate amount of uric acid. Second bleeding, clot normal. A moderate amount of uric acid in blood.
Much night work lately; Much exposed to cold.	Commenced at night, in ball of left great toe, then outer side of ankle. Considerable pitting on pressure. Pulse slow. Appetite pretty good. No deposits of urates.	Serum gave much uric acid by thread experiment. Clot normal; serum, sp. gr. 1028·6 at 52° F.
	Same parts affected as before, and right great toe in addition.	Serum of blood gave much uric acid by thread experiment.
Exposed to changes of temperature at work.	Commenced in right ankle, then left wrist, right knee, and right wrist; same affection of ball of right great toe. Pulse 64. No pitting noticed in notes. No deposits on any part of body. Joint affection *immediately* cured when colchicum was administered. Prior treatment gave no relief.	Clot normal; serum alkaline; sp. gr. 1027·6 at 55° F. Abundance of uric acid. *Blister fluid* clear, no coagula. No uric acid. Small quantity only procured, and that from an inflamed joint.
Attacks brought on distinctly by drink.	Toes, ankles, fingers, and wrists. Desquamation of cuticle. Pitting on pressure. Pulse 66. Appetite bad. Blue line on gums. A small deposit of urate of soda in left ear; some distortion of joints.	Clot buffed, not cupped; serum alkaline; sp. gr. 1026·4 at 49° F. Abundance of uric acid by uric acid thread experiment.
Patient thinks exposure to wet and cold.	Commenced in left knee and foot, then right great toe, afterwards both hands, especially index finger of left. Pitting on pressure, and desquamation of cuticle. Pulse 96, sharp. Appetite good. No deposits of urates on any part of body.	Serum clear; sp. gr. 1027. Abundance of uric acid by thread experiment.
After an attack of bronchitis, which it greatly relieved.	Commenced in ball of left great toe, afterwards left knee. Pitting on pressure. Pulse 108, sharp. No deposits of urates on any part of body. At the time of second bleeding, patient suffered from dyspeptic symptoms.	Clot normal; serum alkaline; sp. gr. 1029·2 at 52° F. Thread well sprinkled with uric acid. A former bleeding also gave much uric acid just before joint affection appeared.

FEMALES.

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
E. W.	51	Laundress; a widow.	Regular.	Father had some joint affection in knees and feet. One brother also, with white deposits and crippled limbs.	Good, till within last ten years.	Numerous. First attack about ten years since; knees were affected. Another attack some months afterwards.
M. J.	53	Servant.	Regular, but has lived rather hard at times.	Mother had gout and chalk stones.	Not very good. Phthisical. Died a few months afterwards from chest disease.	First attack.

FEMALES.

Cause of.	Symptoms during Attack.	State of Blood.
None assigned.	Commenced in knees, then ankles, elbows, wrists, and fingers. Pulse 92, rather hard. No deposits of urate of soda.	Clot firm, buffed ; serum alkaline ; sp. gr. 1028·0 at 65° F. A considerable amount of uric acid by thread experiments.
	Affecting the left index finger first, then wrist and shoulders, chiefly small joints of right hand ; left knee and instep. Desquamation of cuticle. No deposits of urate of soda.	Clot firm, slightly buffed ; serum alkaline ; sp. gr. 1029·2 at 46° F. Much uric acid by uric acid thread experiment. Abundance of uric acid found in *serum from blister*, by uric acid thread experiment.
Not assigned.	Commenced about six weeks ago, in ball of both great toes, afterwards knee, when bled, joint disease was not at all intense. Pitting on pressure. No concretions of urates of soda.	Clot cupped and buffed ; serum alkaline ; sp. gr. 1026·8 at 60° F. A moderate amount (small) of uric acid. *Blister serum* alkaline ; sp. gr. 1024·0 at 65° F. A few crystals of uric acid. Second bleeding, clot buffed and cupped ; serum alkaline ; sp. gr. 1027·8 at 62° F. A pretty good sprinkling of uric acid on thread.

Cases of which the minute details were less known.

Name.	Sex.	Account of Patient.	State of Blood.
C. B.	M.	Attack present about three weeks. Undoubted gouty patient. No concretions noticed.	Serum alkaline; sp. gr. 1031·0 at 60° F. 1000 grains gave of uric acid, 0·05 grain.
W. M	M.	Acute attack. Chronic disease of long standing. Always relieved by colchicum. Concretions in ears and joints.	Clot firm, not buffed; serum alkaline; sp. gr. 1027·8 at 66° F. 1000 grains gave of uric acid 0·062 grain.
U. N.	M.	A patient with gout of great toe and foot.	Serum alkaline; sp. gr. 1031·5 at 60° F. 1000 grains gave of uric acid 0·044 grain.
J. N.	M.	Patient with great toe gout.	A small quantity of blood taken. Gave abundance of crystals of uric acid.
T. P.	M.	A painter (wrists and hands affected), gout for ten years. Last attack one year since.	Serum alkaline; 1000 grains gave of uric acid 0·05 grain.
T. H.	M.	Gout. Attack now in right hand. Several deposits of urate of soda in both ears. Edema of inflamed parts.	Clot firm, buffed; serum alkaline; sp. gr. 1028·2 at 70° F. Abundance of uric acid.
M. H.	M.	Patient diagnosed to have gout by a physician.	Clot firm, buffed; serum alkaline. Gave much uric acid by uric acid thread experiment.
J. H.	M.	Gout for many years. Large joints now chiefly affected. Has had great toe affection. Deposits in both ears; but not elsewhere noticed.	Serum of blood contained much uric acid.

Name.	Sex.	Account of Patient.	State of Blood.
C. H.	M.	A patient who has suffered many years from undoubted gouty attacks, bled on account of retrocedence of the affection.	Serum alkaline; sp. gr. 1030·1 at 45° F. Gave much uric acid by uric acid thread experiment.
E. P.	M.	Disease diagnosed as true gout, by a physician. Attack disappearing rapidly.	Serum gave uric acid crystals on thread. Not numerous.
D. P.	M.	Acute attack of gout; the first attack, in great toe for some days.	Serum alkaline; gave on thread abundance of uric acid.
C. S.	M.	Chronic gout. Great toe often alone affected. No deposits of urate of soda seen.	Blister serum gave uric acid by the thread experiment.
J. S.	M.	Painter. Gout of great toe, of 2 days' duration. Admitted for epileptic fits.	Clot firm; buffed; serum alkaline; sp. gr. 1028·0 at 65° F. Abundance of uric acid by thread experiment.
T. P.	M.	Gout, with many concretions in ears, and around joints. Died from fracture of femur.	Blood taken after death. Serum by uric acid thread experiment gave much uric acid.

Discovery of uric acid in the fluid artificially effused by the application of blistering agents.—Some years since an opportunity occurred which enabled me to show that where morbid effusions take place in patients, whose blood is rich in uric acid, the secretions from that fluid likewise contain it; this would naturally be expected, and was proved both as regards the fluid from the pericardium, and also the peritoneum;* such knowledge, however, could not be made of any practical use. It frequently happens that, for the sake of diagnosis, it is desirable to ascertain the condition of the blood, as to the presence or absence of uric acid, in cases where from the state of the patient or other causes, venesection cannot well be employed, and it occurred to me that probably the fluid artificially effused by the application of a blister would contain this acid, if the circulating fluid were impregnated with it; experience proved the truth of this conjecture. The following are some of the results obtained by the use of the uric acid thread experiment, which may be employed for the discovery of uric acid in blister as well as in blood serum.

---

* Medico-Chirurgical Transactions, vol. xxxvii. 1854.

E. W. Feb. 9, 1853.	Serum of blood; sp. gr. 1029·2 at 46° Fahr. Abundance of uric acid on thread.	E. W. Feb. 11.	Serum of blister. Abundance of uric acid.
J. W. March 5.	Serum of blood; sp. gr. 1026·4 at 51° Fahr. Abundance of uric acid.	J. W. March 6.	Serum of blister. Abundance of uric acid.
— R. March 25.	Serum of blood; sp. gr. 1028 at 41° Fahr. Abundance of uric acid.	J. W. March 28. Attack passing off.	Serum of blister; sp. gr. 1022·8 at 46° Fahr. Crystals of uric acid.
J. H. March 29.	Serum of blood; sp. gr. 1029·6 at 47° Fahr. Abundance of uric acid.	J. H. April 1.	Serum of blister; sp. gr. 1024·8 at 54° Fahr. Abundance of uric acid.
C. S. June 30.	No blood taken.	C. S. June 30.	Serum of blister. Numerous crystals of uric acid.
M. J. Nov. 8.	Serum of blood; sp. gr. 1026·8 at 62° Fahr. Crystals of uric acid not very numerous.	M. J. Nov. 11.	Serum of blister; sp. gr. 1024 at 65° Fahr. Crystals of uric acid, several in number.

C. F. Jan. 2, 1854.	Serum of blood; sp. gr. 1026·8 at 50° Fahr. Abundance of uric acid.	C. F. Jan. 13.	Serum of blister; moderate amount of uric acid.

It appears from the above observations that the fluid effused by the action of a blistering agent applied to the skin, will give evidence of the presence of uric acid when the blood from the same patient exhibits the phenomenon. In the performance of the thread experiment the same precautions must be adopted as already given for blood-serum; but in addition another circumstance must be attended to, namely, the application of the blister should not be made to an inflamed surface, for the existence of inflammation, at least of a gouty character, has the power of destroying the uric acid in the blood of the part, and hence prevent its appearance in the serum,* as shown by the subjoined results.

C. F. Jan. 2, 1854.	Serum of blood. Abundance of uric acid.	C. F. Jan 2.	Serum from blister on the dorsum of the hand inflamed with gout. No trace of uric acid.
F. P. Jan 15, 1854.	Serum of blood. Abundance of uric acid.	F. P.	Serum from blister on inflamed (gouty) knee. No trace of uric acid.
C. C. F. Dec. 21, 1853.	Serum of blood. Abundance of uric acid.	C. C. F. Dec. 23.	Serum from blister on inflamed (gouty) knee. No trace of uric acid.

---

* The slight inflammation produced by a blister, does not appear to destroy the uric acid.

During the crystallisation of uric acid in artificially effused fluids, a form somewhat differing from that which occurs in blood-serum is apt to be assumed, as the crystals have a greater tendency to agglutinate together and form irregular masses.

Should further inquiry confirm the conclusion to which the above limited number of observations point, namely, that during the existence of gouty inflammation there is a destruction of the uric acid in the blood of the locality, and other independent researches which I have made appear to favour this idea, it will throw no small light on the pathology of gout, and show the reason of the apparent improvement in the health which frequently follows a severe and prolonged fit of the malady.

Urea in the blood in many cases of gout.—In the Medico-Chirurgical Transactions for 1848, I gave the result of some investigations made on the blood in gout in reference to its containing urea, and came to the conclusion that this principle is sometimes present in excess, although not in quantities at all equal to what is found in albuminuria; at the same time it was suggested that the urea being retained in small amounts might explain, as before hinted at, one of the symptoms of gouty inflammation, namely, the frequent presence of slight edema. Since this period I have made further observations, and find my original statement holds good; explainable in many of the cases by the presence of albumen in the urine, so common in gout, a fact which will be fully demonstrated in our next chapter. Dr. William Budd, in a paper read before the same Society in 1855, confirmed my original statement, though he ascribed the presence of urea to the decomposition of uric acid, and not to any defect in the excreting power of the kidneys; an explanation totally insufficient to account for the accumulation, provided the function of the renal organs remains intact. Dr. Budd gives details of two cases, and mentions that he has detected urea in the blood or blister serum of seven other persons suffering from acute gout. In none of the cases was albumen found in the urine, nor was there any other indication of the presence of renal disease. In all, the local inflammation ran high, and in the greater number several joints were severely affected. It will be seen, however, that a trace of albumen is frequently present in the urine during the height of the gouty paroxysm, though not discoverable at any other period.

We may conclude from these observations, that urea is often contained in abnormal quantities in the blood in gout; whether it is so in the very early attacks, when the disease has been confined to the ball of the great toe, has yet to be determined; at such times we certainly find uric acid in excess.

Occurrence of oxalic acid in gouty blood.—Some years since* I detected oxalic acid in the blood of a patient labouring under albuminuria, whether or not he had suffered from gout I am unable to say. The acid was separated from the watery solution of the serum, mostly in the form of octohedral crystals of oxalate of lime, but mixed with small oval bodies somewhat resembling the dumb-bell varieties of this salt (Plate 6, fig. 3, *a*, *c*). I have also examined the blood for this acid in many cases of gout, and have frequently detected it; my impression is that it chiefly occurs during the inflammatory stage of the disease, and if so would probably be derived from the disintegration or oxidation of the uric acid which may take place at that time.

---

* Medico-Chirurgical Transactions, vol. xxxii. 1849.

The whole subject is beset with difficulties, and, until many other observations have been made, I should not wish to venture any positive statement, except as to the fact of the occurrence of this acid in the blood of gouty subjects.

Traces of uric acid and urea in healthy blood.—In 1848, in the postscript to my communication in the Medico-Chirurgical Transactions already referred to, I stated that I had not only discovered uric acid in the blood of gouty patients, but had found it also in healthy human blood. This statement having been somewhat misunderstood, it may be well to explain my views a little more fully.

It has been asserted that, as uric acid has been found in the blood in health as well as in gout, the importance of the latter fact becomes greatly diminished; but, on consideration, this deduction will be found erroneous. In health, mere traces exist:

quantities which require the employment of a large amount of blood, and the most careful chemical manipulation to enable us to detect even its presence, and which cannot be shown by the thread experiment. The same objection might, with equal truth, be urged against the value of the presence of urea in cases of albuminuria, because I have also detected this principle in healthy blood; the difference in the amount, however, in the two cases, is very great. Traces of all the principles contained in the urine are probably present in the blood, although it is only from defective excretion that they accumulate in sufficient quantities to become the source of disease.

Carbonic acid is a natural constituent of the atmosphere, and also of the blood; but it is only when its proportion is increased beyond a certain limit, that it proves injurious to the functions of the animal economy.

Secretion from the skin in gout.—There are many instances on record in which a whitish powder has been noticed as occurring on the skin of gouty patients, especially after profuse perspiration, and it has been frequently supposed to consist of some combination of uric acid; but in most cases rather assumed than proved to be urate of soda. Swediaur stated that he had seen a patient labouring under a severe gouty paroxysm of several months' duration, who had the entire surface of the body covered every morning with a white powder, as though he had been dusted with flour. Wolff thought he had detected uric acid in the perspiration from a patient suffering from calculus, and the same was stated to occur by Dr. Mayer, of Madras, in the case of a gentleman who also suffered from stone in the bladder, and suppression of urine. In the latter instance, I think the statement is open to doubt, as the acid was obtained from the shirt worn by the patient, who had recently had a blister applied to the back, and we have shown that blister serum is at times rich in this principle.

Dr. Golding Bird, in his work on urinary deposits, also mentions having noticed the appearance of frosting, with microscopic crystals of urate of soda, on parts in which the exudation of an eczematous eruption had dried, the patient being bed-ridden from rheumatic gout. It is not however said that these crystals were chemically examined. The most positive statements on this subject were made by Dr. Charles Petit, who affirmed that he had taken the cuticular secretion from the skin of gouty patients, occurring at the termination of an attack, and had it chemically examined by M. Henry. The first portion was from the hand of a patient fifty-six years of age, who had suffered from the disease from the age of twenty-four. It contained about four-fifths of its weight of albumen, some lactic and phosphoric acids, chloride of sodium, and phosphate of lime, together with sensible traces of urate of soda. In another instance, the matter was taken from the surface of the chest; in a third, from the back of the foot; in these specimens, also, M. Henry demonstrated the existence of urate of soda.

Some objection, perhaps, might be urged even against these results, especially when the matter was derived from the hands or feet; for if the patients were the subjects of chalk-like deposits of urate of soda, a portion might possibly have been detached with the cuticle, as they frequently approach the surface, and often become completely exposed.

Some years since I adopted the following method to ascertain if uric acid be thrown out in the perspiration of gouty patients: A man was selected suffering from a severe attack of gout; he had been subject to the disease for a long time, and had many tophi, or concretions of urate of soda; his blood also gave evidence of containing a large amount of this principle. Several folds of white bibulous paper were steeped in a weak solution of potash, and applied for about thirty hours to the abdomen, protected by oil-silk. The papers were rendered acid, and found to be strongly impregnated with the perspiration, and to contain much organic matter; they were treated with rectified spirit, and afterwards with hot water, and the watery solution, when evaporated, carefully examined for uric acid. No trace of this body could be discerned by the murexide test, nor any separated by the addition of acetic acid.

More recently I have made two other observations with reference to this subject: A man was selected, suffering severely from gout, with extensive deposits of urate of soda in different parts, the great toe being greatly affected, as shown in Plate 1, fig. 3. The cuticle from this part being very thick, was detached, and after digestion in alcohol, treated with warm water; the watery solution was then evaporated, and acetic acid added. After remaining for some hours, a very few microscopic crystals of uric acid were discovered. In this experiment some error may have arisen from the very close proximity of the deposits of chalky matter to the surface, as is well indicated in the drawing.

In the second case the hand, fore-arm, and arm of a gouty patient were placed in a very long and wide glass jar, the vapour being prevented from escaping by means of caoutchouc sheeting attached to the arm; a considerable quantity of the perspiration, amounting to several drachms, was thus collected, and subjected to analysis. No uric acid could be discovered, either in the form of crystals, or by the murexide test; but in lieu of this body a considerable quantity of *oxalate of lime* was found, a portion of which had crystallised on a fibre in the evaporated liquid, and exhibited the appearance seen in Plate 5, fig. 6, which was taken from a drawing made at the time. It will be observed that the crystals are of the octohedral variety (Plate 6, fig. 3 *a*), and some are aggregated together in the form of rudimentary calculi. The patient from whom the perspiration was taken was suffering from an acute attack of the disease, although the arm itself was not implicated. A large amount of uric acid was present in the blood.

After an investigation of the various conflicting statements, with regard to the secretion of uric acid by the skin, I feel desirous to pause, and await the result of more numerous observations, before giving a positive opinion. Considering the nature of the excretion from the skin, it would hardly seem probable that a body possessing the properties of uric acid should be thrown out with it, either in its free state, or in the form of a salt. I could easily imagine that the fluid from eczema, or, in fact, from any other cutaneous eruption, when occurring in patients whose blood is rich in uric acid, would contain this principle, because such secretions are alkaline, and bear a close resemblance to the serum effused by the application of a blister.

CHAPTER V.

URINE IN GOUT:—CHARACTERS OF HEALTHY URINE—TABLE EXHIBITING THE COMPOSITION OF URINE AND THE DAILY ELIMINATION OF ITS DIFFERENT CONSTITUENTS—URIC ACID—THE MANNER IN WHICH IT EXISTS IN THE URINE—RELATION BETWEEN THE ACIDITY OF URINE AND THE URIC ACID CONTAINED IN IT—CONDITION OF THE URINE IN ACUTE GOUT—NO EXCESSIVE EXCRETION OF URIC ACID IN MANY CASES—ELIMINATION OF THE UREA BUT LITTLE INFLUENCED—URINE IN CHRONIC GOUT—DEFICIENT EXCRETION OF URIC ACID—NO MARKED DEFICIENCY IN THE EXCRETED UREA—FREQUENT PRESENCE OF SMALL AMOUNTS OF ALBUMEN—URINE OF GOUTY INDIVIDUALS IN THE INTERVALS OF THE FITS—PROBABLE EXPLANATION OF THE FREQUENT RETURNS OF GOUT—MICROSCOPIC CHARACTERS OF THE URINE IN DIFFERENT FORMS OF GOUT.

BEFORE attempting to explain that which has hitherto been ascertained concerning the alterations of the urine in gout, or what, from our own observations and experiments, we have recently arrived at, it will be desirable briefly to bring under notice some of the more important properties of this secretion in the human subject.

The urine when first passed is of a bright amber colour, transparent, with a peculiar characteristic odour and distinct acid reaction; but when allowed to stand for a short time, a fine flocculent cloud is deposited, consisting of mucus with a few epithelium scales.

The urine is subject to numerous changes, both in appearance and composition, at different periods of the day, and hence was divided by the ancients, who only studied its physical appearances, into the *urina potûs,* secreted shortly after ingesting a considerable quantity of drink, and often observed in that passed by individuals in the early part of the day; *urina cibi,* the urine passed during the digestion of a solid meal; and *urina sanguinis,* the urine secreted from the blood, and uninfluenced by food, or such as is passed most commonly on first rising in the morning; the urina potûs has a pale colour, and low specific gravity, the urina cibi is both heavier and darker, whereas the urina sanguinis is intermediate in character.

The amount of urine passed in the twenty-four hours is likewise subject to considerable variations, depending on many circumstances, as individual peculiarities, the amount of fluid ingested, and the condition of the atmosphere; it may be regarded as a rule, that between the skin and kidneys a vicarious action exists, or that when the secretion of the skin is large the urine is scanty, and vice versâ; still a pretty close approximation to the average may be arrived at. Dr. Prout considered that the daily quantity in summer is 30 fluid ounces, in winter 40 fluid ounces, giving as a mean 35 ounces; he also thought that the specific gravity in health varies from 1015 to 1025, the average being 1020. M. Becquerel gives as the average specific gravity of the urine of both sexes 1017, and the average quantity in the twenty-four hours about 46 fluid ounces, or twenty thousand grains.

In composition, urine may be represented as water holding in solution certain organic substances, many of which are peculiar to this secretion and the products of changes constantly taking place in the system, and saline matters, chiefly derived from the food. Some of the best analyses of the urine in health, are those made by M. Becquerel on several individuals of both sexes, and especially valuable, inasmuch as they include, not only the composition of this fluid in the 1000 parts, but also the total elimination during the twenty-four hours.

The following table shows the results arrived at, reduced to English grains and fluid ounces:*

	Male.		Female.		Mean.	
	Urine of 24 hours.	In 1000 parts.	Urine of 24 hours.	In 1000 parts.	Urine of 24 hours.	In 1000 parts.
Quantity of urine	44 fl. oz.	1000	48 fl. oz.	1000	46 fl. oz.	1000
Density	1019		1015		1017	
Water	18949·6	968·8	20642·8	975·1	19796·2	971·9
Solids	609·9	31·2	528·0	24·9	568·9	28·1
Urea	270·7	13·8	240·4	10·4	255·5	12·1
Uric acid	7·6	0·4	8·6	0·4	8·1	0·4
Fixed salts	150·5	7·7	130·0	6·1	140·3	6·9
Organic and Volatile Saline Matters	181·1	9·3	149·0	8·0	165·0	8·6

---

* Séméïotique des Urines, par M. Becquerel.

Under the head of *fixed salts,* chlorides, phosphates and sulphates of potash, soda, lime, and magnesia are included; and under *organic and volatile saline matters,* creatine and creatinine, hippuric acid, colouring, and many at present undefined extractive matters are grouped, with traces of ammonia salts.

The results contained in the table are not supposed to be absolute, for considerable oscillations may take place within the limits of perfect health.

As we shall dwell particularly upon the alterations of certain of these components, and especially of the uric acid and urea, when considering the urine of gouty subjects, it will be desirable to notice them a little more in detail, and also allude to some of the more important characters of the renal secretion.

The *specific gravity* or density of the urine varies with the amount of solid matters contained in it; but it must be remembered that we cannot, with any approach to accuracy, determine their quantity by the specific gravity alone, as the same weight of different substances dissolved in water gives to that fluid very different degrees of density. Sugar, for example, increases the bulk of water more than salt, and a solution of these two bodies of the same density would contain much more of the former than of the latter ingredient; so it is with regard to the urine of different patients, or in varied states of health, and even at different periods of the day. When the whole of the urine is collected, the diet of the patient remaining the same, then the density will give a somewhat close approximation to the quantity of solid elimination in the twenty-four hours. In the analyses we shall have to detail, the density is frequently stated, and tolerably accurate deductions as to the amount of solids may often thus be drawn.

The next property to consider is the *acidity* of the urine. It must be remembered that in health the secretion is acid, probably always so in perfect health, although at different periods of the day it is subject to considerable variations, depending on the condition of the stomach with regard to the digestive process. It has been clearly shown by Dr. H. Bence Jones that immediately before each meal the urine exhibits the highest degree of acidity, and that which is passed two, three, or more hours after food always shows a much lower degree; the decrease being greatest three hours after breakfast, and five or six hours after dinner, when it reaches its lowest point. The acidity of the urine again increases until immediately before a meal, when it attains the highest limit; animal food causes a greater and more permanent decrease of acidity than vegetable. There is one fact that must be carefully borne in mind, namely, that the presence of *uric acid* has no influence upon the acidity of the urine; for this reaction probably depends, not on the existence of any free acid in the fluid, but upon the presence of the acid phosphate of soda, although in some cases of disease it is not unlikely that the occurrence of free acids may add to the acidity.

The *colour* of the urine in health is in the inverse ratio to the quantity passed. When the urine from any cause is scanty, the colour becomes deeper; and, on the contrary, when a large quantity is passed, it is much paler. In disease, however, the colouring matter is subject to considerable variation, not only in quantity, but in composition also.

The daily average of urea, according to the above table, is 258 grains, or 270·7 grains, in the male, and 240·4 in the female. Lehmann found, from experiments on his own person, that when living on a mixed diet he passed 500 grains; on an animal diet, as much as 819 grains; on a vegetable diet, 346 grains; and lastly, on non-nitrogenised food, 237 grains; but the averages of this physiologist are, doubtless, very large, not only for urea, but likewise for uric acid. In this country the average may be taken at about 450 grains when an individual is in perfect health, and is living well; but we shall find many of the analyses for urea, detailed in the present chapter, fail to exhibit this amount; but as they were on the urine of patients who were kept on a moderately spare diet, on account of the affection under which they were labouring, we cannot conclude from this fact that the excreting power of the kidneys was deficient. The mode of analysis adopted for the determination of the urea and uric acid will be found in the Appendix.

Most of the analyses upon which we shall have to comment having especial reference to uric acid, the consideration of this principle becomes invested with considerable interest and importance. We have seen from Becquerel's table, that eight grains is the average quantity passed by the healthy human subject, and many other investigators have arrived at a similar result; but uric acid is a body which in its free state is scarcely soluble in water, requiring from twelve to fifteen thousand parts for solution at the ordinary temperature of the air, and of most sparing solubility even in boiling water. How, then, does it exist in the urine, seeing that the quantity of water passed daily is not equal to the task of holding this eight grains in solution? Many and varied opinions have been advanced by different chemists to account for this fact. Berzelius considered that it is rendered soluble by the colouring matters of the secretion; Dr. Prout, that there exists an acid urate of ammonia in the urine, which imparts to it the acidity. It appears from more recent observations, that uric acid is present in the urine chiefly in the form of urate of soda, which is capable of existing without decomposition, in a solution of the acid phosphate of soda. It is, therefore, evident that there is no necessary relation between the amount of acidity and the quantity of uric acid present in the urine, and the uric acid is not in proportion to the amount of acidity, but rather, as the experiments of Dr. Bence Jones appear to indicate, the reverse more frequently, holds good; or at the time the urine is very acid, there is but little uric acid present, and when uric acid exists in large quantities, the urine is sometimes neutral in reaction. It is likewise very important to bear in mind, that the presence of a urate deposit is no proof of an excess of uric acid in the urine, for urate of soda is held in solution in smaller or larger quantities in proportion to the acidity of the urine; this is readily shown by adding a drop or two of an acid, such as acetic acid, to a dense and almost neutral urine; if much uric acid be present, a copious cloudy deposit of urate of soda will immediately take place, which is subsequently converted into crystallised uric acid by the influence of the free acid which has been added. The same result often ensues, when a few drops of nitric acid are added in the cold, and the precipitate which at first appears white and flaky, has often been mistaken for albumen.

Not unfrequently, if the urine be very acid, either from containing free acid at the time of its emission, or from its speedy formation on account of a change in some of its components, uric acid becomes deposited generally in the form of rhombs, more or less coloured and extremely diverse in shape. (Plate 6, fig. 1.) Urine which has given rise to such crystalline deposits, contains scarcely a trace of uric acid in solution; it is, in fact, in the same state as after the addition of a foreign acid.

Dr. Bence Jones has summed up the results of his experiments on acidity and the deposition of urates as follows:—

"A slight excess or increase in the acidity of the urine will cause the precipitation of urate of ammonia; and the less acid the urine is, the less likely is the urate of ammonia to be precipitated. I have shown how the acidity varies, how the urine becomes more acid and more nearly alkaline, at different hours of the day, and thus the precipitation of urate of ammonia must be greatly influenced. If the urine tends to alkalescence, an excess of urate of ammonia will be dissolved, and will show no appearance of superabundance of urates. If the urine is highly acid, a precipitate may occur, even when no excess of urate of ammonia exists in it. Direct experiment shows that the precipitation of urate of ammonia depends generally on the action of both these causes conjointly. If a very small quantity of urate of ammonia exists in the urine, it may be highly acid, without a marked precipitation taking place. If a very large quantity of urate of ammonia is present in the urine; it may give no precipitate if the urine be alkaline. Precipitation usually occurs when there is a slight excess of urate of ammonia, and a slight excess of acidity also, aided always by a low temperature."

Has clinical observation thrown any light upon the changes which occur in the urine in gout? In most of the works devoted to the consideration of the disease, little that is satisfactory can be found; some authors altogether pass over the subject, others content themselves with giving a very meagre account of the condition of this important fluid, and errors and discrepancies are constantly met with. Perhaps the most prevalent idea is, that uric acid is thrown out in excess; and in support of such view it is stated that deposits of uric acid and urates are so frequently seen in the urine of gouty patients, and these are so copious in amount, that the appearance of brick-dust sediment has been regarded as almost characteristic of the urine in this disorder; added to which, there is a prevalent impression that gouty patients are liable to attacks of nephritic gravel, which would, at first sight, appear to strengthen the above generally received opinion.

This subject is treated more ably and fully by the late Sir C. Scudamore than any other writer; and the substance of his remarks may be seen in the following quotations: "The urine is of a deeper colour than natural, is secreted scantily with relation to the quantity of the patient's drink, and on cooling, deposits a pink or brick-dust sediment, with much mucus. The specific gravity is much increased beyond the healthy standard. During the most urgent symptoms of the paroxysm it is usually passed with considerable irritation, both as to frequency and sense of heat. The pink or lateritious sediment appears more or less in every portion of the urine during the inflammatory symptoms."

This description of the condition of the urine is intended to apply to genuine acute gout, occurring in patients who have not previously suffered from the disease in its more chronic forms; for it is remarked in other parts of the same work, that "it is very commonly found upon inquiry, that the patient has noticed a very deficient secretion of urine a short time before the occurrence of the paroxysm, and consequently it has been of a deeper colour than natural. It also now and then certainly occurs, that for a day or two before the fit, the urine is passed copiously and of a pale colour; but this seldom happens except in persons of a nervous temperament, and whose constitutions have been much weakened by gout." Again, the same author observes, "A deposition of pink or brick-dust sediment on the cooling of the urine, is of such ordinary occurrence when any active symptoms of gout are present, that its connexion becomes forcibly impressed on the mind of the patient, and he gives it the name of gouty urine." These statements agree in the main with those of other writers who have noticed the condition of this secretion; but, on the other hand, it is observed by Sir C. Scudamore, that, "in several examples of chalk stones, both in the hands and feet, I have found by repeated experiments a deficiency, and sometimes total absence of uric acid in the urine. I must add, however, that even in patients of this class, during the paroxysm, this principle has existed in the urine in considerable quantity, and in some cases to the extent of a copious deposit of pink sediment."

The above statement as to the physical appearances of the urine in different forms of gout, are, I believe, essentially correct, and my own observations are by no means antagonistic to them, although I consider the deductions which have been usually drawn from these appearances of the urine, very erroneous.

M. Berthollet found that a few days before the access of a gouty paroxysm, the urine lost its natural *acidity*, but regained it before the termination of the fit. M. Fourcroy, in reference to these observations of Berthollet, expressed a desire that the urine of gouty patients should be examined, to see whether the *uric acid* was likewise deficient during an attack of the disorder. In many works it has been asserted that M. Berthollet found the uric acid deficient or absent at such times; a statement which appears to have arisen from an idea that the acidity of the urine and the presence of uric acid in it were dependent on each other, which we have already had occasion to show is not the case.

I shall divide my clinical examinations of the urine in gouty patients, made during the last twelve years, into three classes:

The first includes analyses of the urine in cases of acute gout; the second, examinations on patients suffering from the chronic form of the disease; and in the third class will be found the results obtained in gouty individuals at a time when they were not experiencing any symptoms of their disorder.

CLASS I.—*Urine of subjects suffering from Acute Gout, but in whom the general health had usually been good during the intervals of the paroxysms.*

In hospital practice there is considerable difficulty in procuring these cases; for few patients enter such institutions suffering from a simple attack of acute gout, and there is often a great tendency, among the labouring classes, for the disease to assume after a short time an asthenic and chronic form; this tendency is much more strongly marked than in the upper classes of society, but, on the other hand, in private practice it is not easy to procure the twenty-four hours' urine, unless the patient himself takes an interest in the investigation.

Case 1. W. R., a male, aged 32, having no visible deposits of urate of soda upon the cartilages of the ears or elsewhere, occasionally suffered from gout for seven years; in the first attack, the balls of both great toes were specially affected. At the time the urine was examined, the right foot and ankle and some of the smaller joints of the hands and right wrist were inflamed with acute gout, being painful, red, swollen, and pitting on pressure; there was also considerable febrile disturbance.

March 24, 1853.—Urine of 24 hours, 35 fl. ounces; sp. gr. 1019. Clear.

Amount of uric acid in 24 hours = 5·95 grains.

The blood of this patient was found to be rich in uric acid. No medicine was taken at the time of the examination.

Case 2. W. B., a male patient, aged 46. The attack of gout commenced at night in the ball of the left great toe; the outer side of the ankle afterwards became affected, accompanied with much pitting on pressure; febrile disturbance slight.

Feb. 20, 1853.—Urine of 24 hours, 42 fl. ounces; sp. gr. 1012·5. Acid. No deposit of urate.

Uric acid passed during the whole day = 0·84 grains.

Feb. 21.—Urine of 24 hours, 46 fl. ounces; sp. g. 1015. Acid.

Uric acid of whole day = 1·84 grains.

Feb. 22.—Urine of 24 hours, 63 fl. ounces; sp. gr. 1012. Acid.

Uric acid of whole day = 2·52 grains.

After this time the patient took colchicum for a day or two, which produced purging; the medicine, however, had been discontinued before the next examinations of the urine were made.

Feb. 26.—Urine of 24 hours, 18 fl. ounces; sp. gr. 1023. Acid.

Uric acid of whole day = 2·30 grains.

Feb. 27.—Urine of 24 hours, 36 fl. ounces; sp. gr. 1015. Acid.

Uric acid of whole day = 2·76 grains.

From Feb. 20 to Feb. 22 the gouty symptoms gradually subsided; and after the latter date, little else remained than tenderness of the parts previously inflamed.

The blood of this patient was shown by analysis to contain abundance of uric acid.

Case 3. J. C., a male patient, aged 57, suffering from acute gout in the ball of both great toes, and in several other joints both of the upper and lower extremities. A few nodules of urate of soda found in the ears, but in no other parts of the body.

May 2, 1856.—Urine, 24 fl. ounces; sp. gr. 1024, at 60° Fahr. Turbid from urates, but clearing with moderate heat; it contains a distinct trace of albumen.

Uric acid, in the 24 hours = 3·76 grains.
Urea, ditto = 320 grains.

The blood of this patient contained much uric acid.

Case 4. J. P., a male patient, aged 46. Has had several attacks of gout during the last ten years; no apparent alteration of any joint produced by the disease; but in one ear a single spot of urate of soda is seen upon the helix. When the urine was analysed the patient was suffering from slight but increasing gouty inflammation, affecting both the ankles and right elbow. During the first three days that the examinations of the urine were made, no medicine was taken; on the fourth, colchicum was administered, and continued during the fifth and sixth days; under the influence of this drug the inflammation of the joints rapidly subsided.

Feb. 15.—Quantity, 58 fl. ounces; sp. gr. 1020.
Uric acid, in 24 hours = 8·12 grains.
Feb. 16.—Quantity, 58 fl. ounces; sp. gr. 1020.
Uric acid, in 24 hours = 8·12 grains.
Feb. 17.—Quantity, 43 fl. ounces; sp. gr. 1020.
Uric acid, in 24 hours = 3·44 grains.
Feb. 18.—Quantity, 50 fl. ounces; sp. gr. 1020.
Uric acid, in 24 hours = 4·00 grains.
Feb. 19.—Quantity, 59 fl. ounces; sp. gr. 1020.
Uric acid, in 24 hours = 2·95 grains.
Feb. 20.—Quantity, 42 fl. ounces; sp. gr. 1020.
Uric acid, in 24 hours = 0·17 grains.

No albumen could be detected in the urine, which was acid in reaction.

The blood was found to be rich in uric acid.

Case 5. T. D. M., a male patient, aged about 50 years, for more than twenty of which he has suffered from gout; several small deposits of urate of soda upon the ears (Plate 1, figure 2), and many of the articulations have chalk-like deposits around them.

On the 8th of January, 1853, several joints were swollen and red from acute gouty inflammation, the note of the day being as follows: "Swelling, heat, redness and tenderness of dorsum of right hand and wrist, also of left wrist; considerable pitting of the hand on pressure. Right knee swollen, red, and tender; left knee affected in a less degree. Pulse 100, rather full and hard; skin hot and moist." On the 11th the gouty pains were almost gone, and the joints somewhat moveable; pulse 72. Jan. 15th, quite free from pain; pulse 64. Jan. 18th, cured.

On the 8th, twenty minims of colchicum wine were prescribed three times a-day, with half a drachm of magnesia and fifteen minims of tincture of opium; the opium was omitted on the 11th after the pain had subsided. The urine under date January 9th, was passed between 10 A.M., January 8th, and 10 A.M., January 9th, and so on for the remaining days.

Date.	Quantity: fl. oz.	Sp. gravity, at 60°.	Reaction.	Appearance.	Uric acid in 24 hours: grains.
Jan. 9	10·5	1016·5	Acid.	Dark claret red. No deposit and no albumen.	0·5
,, 10	26	1014	,,	Ditto	1·7
,, 11	32	1013	,,	Lighter colour. Uric acid deposit.	5·3
,, 12	36	1013	,,	Clear yellow	5·5
,, 13	28	1016	,,	Clear	5·5
,, 14	14	1016·5	,,	Ditto	4·0
,, 15	18	1019·5	,,	Ditto	3·3
,, 16	18	1019	,,	Ditto	3·6
,, 17	25	1016·5	,,	Ditto	3·4
,, 18	36	1015·5	,,	Ditto	2·9

At the commencement of another attack, the urine of the same patient was examined before the administration of medicine, with the following result:

Quantity, 17 fl. ounces; sp. gr. 1021. Acid.
Uric acid in 24 hours = 0·425 grains.

During acute attacks the urine of this patient gave evidence of the presence of a small quantity of albumen, which could not be detected in the intervals.

The blood was examined several times during some years, and always yielded abundance of uric acid, when treated in same manner.

Case 6. B. F., male patient, aged 38, has suffered, during the last seven years, from five or six attacks of gout. No deformity of joints and no visible deposits of urate of soda in any part. From the 16th to the 19th of January suffered considerably from inflammation of the left knee, both hands, and right great toe. The urine was uninfluenced by medicine when the examinations were made.

Jan. 15.—Urine, 25 fl. ounces; sp. gr. 1012, at 60° Fahr. Acid. No albumen.
Uric acid eliminated in the 24 hours = 1·30 grains.

January 16.—Urine, 30 fl. ounces; sp. gr. 1010. Acid.
Uric acid eliminated in the 24 hours = 1·95 grains.

January 17.—Urine, 26 fl. ounces; sp. gr. 1012. Acid.
Uric acid eliminated in the 24 hours = 2·73 grains.

January 18.—Urine, 39 fl. ounces; sp. gr. 1011. Acid.
Uric acid eliminated in the 24 hours = 2·14 grains.

January 19.—Urine, 47 fl. ounces; sp. gr. 1009. Acid.
Uric acid eliminated in the 24 hours = 3·05 grains.

The blood of this patient was rich in uric acid.

Case 7. W. F., a male patient, aged 41, has had several attacks of gout during the last ten years. Some small urate of soda deposits are seen on the palmar surface of left index finger, but none on ears. An acute attack now passing off (March 27th).

March 27, 1858.—Urine, 24 fl. ounces; sp. gr. 1024. Acid in reaction. Of an amber colour, and depositing a yellow urate sediment on cooling.

Uric acid passed in 24 hours = 5·20 grains.

Urine crystallised freely with nitric acid.

April 8.—Has been free from all acute symptoms for some days. Urine, 48 fl. ounces; sp. gr. 1017. Acid. Clear, no deposit.

Uric acid passed in the 24 hours = 1·36 grains.

From a review of the results of these cases it will be observed that, as far as hospital patients are concerned, the daily excretion of uric acid during a fit of gout is not necessarily increased, nay, often notably diminished; for taking the average normal excretion at 8 grains in the twenty-four hours, it will be seen that in the seven cases just detailed the highest amount reached was only 8·12 grains, the lowest 0·425 grain, and the averages of the seven cases, 5·95—2·05—2·58—3·76—4·46—3·28—3·28 grains, and the total average derived from all the analyses 3·62 grains. Several of the urines were high coloured, some were turbid from urates, and in others there was a deposition of crystallised uric acid; in a few, the secretion was clear and free from all sediment. The above analyses were, as I have before observed, of the urine of hospital patients, and I have none, nor can I find any of other observers, showing accurately the daily elimination of uric acid in acute gout among members of the higher classes of society, although I have been frequently able to determine this point in the more chronic forms of the disease. I am convinced that the cause of the prevalent idea that there is always an excess of uric acid thrown out of the system by gouty individuals, and especially in the acute forms of the disease, is derived from the fact that, when febrile disturbance runs high, the renal secretion usually becomes scanty, its acidity is increased, and therefore almost the whole of the uric acid is rendered visible to the eye; at the same time, the tendency of uric acid to attract the colouring matters of the urine, adds greatly to this appearance of excess.

Having now established the fact that patients suffering from acute gout do not necessarily excrete excessive quantities of uric acid, but that even the reverse is not uncommon, it becomes an interesting question to ascertain whether this defect depends on any diminution in the formation of this principle in the economy, or from its imperfect excretion by the kidneys. This question is fortunately not difficult to determine; for the blood was examined in every instance, and proof afforded by the analyses, that in each there existed a considerable abnormal quantity of uric acid in the serum; thus proving indubitably that the renal organs were unable to excrete the amount of uric acid formed in the system; and as the elimination of this acid was shown to be under the average, demonstration was afforded that the kidneys had lost, at least temporarily, a portion of their usual power. In many other disorders where an abnormal formation of uric acid takes place, as in cases of diseased liver and spleen, although the production of uric acid may be greatly augmented, still, the kidneys retaining the power of fully eliminating it, the blood is kept free from this principle. In subjects suffering from acute gout, we have now shown that such does not ensue; and the knowledge of this fact is of considerable importance, as it is frequently assumed that the appearance of a large quantity of uric acid in the urine indicates that the blood is contaminated with the same body, whereas on reflection it will be at once evident that such an occurrence favours the opposite view, for if the kidneys excrete freely, the blood has a much greater chance of being pure.

From the results obtained in the above analyses it will also be observed, that the quantity of uric acid eliminated during different days is liable to much variation; as a rule, in the early stages of an attack, the excretion of this acid is small, it then gradually augments, and when the fit is passing off again diminishes. In Case 4, the quantity was greatest during the first two days in which the analyses were made, but in this instance they were not undertaken until the disease was abating.

My present experience on the subject shows, that in the earlier stages of acute gout the urine is scanty, and the uric acid, measured by the twenty-four hours' excretion, also diminished; that this acid is thrown out in much larger quantities as the disease is passing off, and that then amounts, even far above the patient's daily average, may be excreted, frequently forming the so-called critical discharges; lastly, the uric acid is again lessened, although not to the extent observed prior to, or at the commencement of an attack.

In one of the above Cases the daily amount of urea was estimated and found to be 320 grains; a fair average for a patient on a low diet. The elimination of the urea is, therefore, not affected in the same ratio as the uric acid, although I have ascertained from repeated experiments, as observed in the last chapter, that the blood in the acute forms of the disease usually contains a slight abnormal amount of this latter principle.

Sometimes a very distinct trace of albumen is present in the urine in acute gout; this occurred in two of the Cases above quoted. The phenomenon is not, I believe, at all common in the early attacks; but as the disease assumes a more chronic condition, and especially when deposits of urate of soda are found, then, during the fit, traces of albumen are frequent, although in the intervals not the slightest evidence of the existence of this body can be obtained.

CLASS II.—*Urine of subjects affected with Chronic Gout, the majority of them at the time the examinations were made had no very urgent symptoms, but were suffering from the sequelæ of this disease, as shown by the presence of concretions of urate of soda in different parts of the body, and the stiffened and deformed condition of the joints.*

Case 1. J. H., a male subject, aged 45 years. Had suffered from gout for fourteen years; small deposits of urate of soda present in the cartilages of the ears, but the joints not deformed. When the urine was examined, he was suffering in the feet and ankles, and also in the right knee. No medicine was administered at the time.

March 30, 1853.—Urine, 56 fl. ounces; sp. gr. 1011. Clear, yellow, not giving rise to any deposit; a very slight trace of albumen present.

Uric acid in 24 hours = 5·78 grains.

The blood contained much uric acid.

Case 2. J. M., a gentleman, aged 85 years. Has suffered from gout for fifty years. Concretions of urate of soda extensively diffused over his body; gouty abscesses of fingers, discharging chalk-like matter.

June, 1856.—Urine passed at 3 P.M., sp. gr. 1017. Pale yellow; clear; gives evidence of a small amount of albumen.

With hydrochloric acid this urine only deposited a few crystals of uric acid, requiring the microscope to detect them.

The urine of the same patient, passed during the night, was pale, sp. gr. 1018. Acid, with distinct traces of albumen; and gave, when acidulated with hydrochloric acid, only a few microscopic crystals of uric acid.

Case 3. W. L., a gentleman, aged 61. Has suffered many years from gout, his hands and feet much deformed from the presence of extensive deposits of urate of soda.

May, 1857.—Urine passed three or four hours after dinner of a pale yellow colour; sp. gr. 1015. Acid in reaction; slightly, though decidedly, albuminous. When acidulated with hydrochloric acid, gave merely a few microscopic crystals of uric acid, not sufficient to collect and weigh.

Case 4. A male patient, aged 52. Has suffered from gout for many years; some deposits of urate of soda seen on both ears, but not elsewhere. No active gouty symptoms at the time of the urinary examination; urine always pale, and free from deposits.

October 22, 1849.—Urine, 72 fl. ounces; sp. gr. 1010.

October 27.—Urine, 56 fl. ounces; sp. gr. 1012, at 60° Fahr. Uric acid, from 24 hours' urine = 0·38 grain.

November 4.—Urine, 52 fl. ounces; sp. gr. 1009, at 60° Fahr. Acid. Uric acid in 24 hours = 0·20 grain.

The blood was found to be rich in uric acid.

Case 5. R. H., a male subject, aged 41 years. Suffering from chronic gout of several years standing; a few nodules of urate of soda seen upon the cartilages of the ears, and on the palmar surfaces of one or two fingers, near the extremities. No active gouty symptoms present at the time the analyses were performed.

June, 1847.—Urine, 42 fl. ounces; sp. gr. 1015. Acid; pale in colour; very slightly albuminous.

Uric acid from the 24 hours' urine amounted to only a few microscopic crystals.

Many other examinations of this patient's urine were made within the course of the following month or six weeks, with like result.

It was in this patient's blood, at the time above referred to, that I first discovered the presence of uric acid; from it also I was enabled to crystallise urate of soda in the form shown, Plate v. fig. 4.

Case 6. D. R., a male patient, aged about 45 years; has suffered from gout for more than ten years;

deposits of urate of soda observed on the ears, and some distortion of the hands.

Urine, 65 fl. ounces ; sp. gr. 1014. Clear ; acid.

No uric acid could be obtained from the entire 24 hours' urine.

Case 7. W. B., a male patient, aged 52. Has suffered from gout for many years, and is much deformed by extensive deposits of chalk-stones, the joints also much stiffened and distorted. Pain and tenderness of different joints almost always present, and likewise gouty abscesses frequently discharging chalky matter. Many examinations of the urine made at different periods.

September, 1848.—Urine, 50 fl. ounces. Pale. Acid.

Uric acid obtained from the 24 hours urine = 0·5 grain.

December 9.—Urine, 36 fl. ounces ; sp. gr. 1014. Acid.

Uric acid, in 24 hours, amounted only to a few microscopic crystals.

December, 1849.—Urine, 60 fl. ounces.

Uric acid, from 24 hours' urine, not in sufficient quantity to weigh.

February, 1850.—Urine, 60 fl. ounces.

Uric acid, from 24 hours' urine, amounted only to a mere trace.

In all the examinations of this patient's urine, a distinct trace of albumen was detected.

Case 8. D. M., a female patient, aged 39. Of spare habit; although the first attack took place only three years since, she is extremely deformed with large chalk-like deposits about the hands and feet; some of the joints always more or less swollen and painful.

1848.—Urine, amount not ascertained; pale; acid; sp. gr. 1010; slightly albuminous. When treated with hydrochloric acid yielded no trace of uric acid.

Case. 9. W. M., a male patient, aged 52. Suffered many years from gout; at present has considerable stiffness of several joints, with deposits of urate of soda upon the ears and elsewhere. No active symptoms present during the time of the urinary examinations.

March 29, 1853.—Urine, 35 fl. ounces; sp. gr. 1016. Clear, yellow; not giving rise to any deposit, but yielding distinct evidence of the presence of albumen.

Uric acid in the 24 hours = 2·5 grains.

On various occasions during the course of many years, this patient's urine was examined; it frequently gave but a mere trace of uric acid, but some albumen was always present. The blood was also analysed, and found charged with the uric acid.

Case 10. W. F., a male patient, aged 38. Has had several attacks of gout, at first implicating only the ball of the great toe, but afterwards affecting several joints of both upper and lower extremities; a few spots of urate of soda seen on the palmar surfaces of left index finger. No active symptoms present when the urine was submitted to examination, and no medicine taken at the time.

May 11, 1854.—Urine, 35·5 fl. ounces; sp. gr. 1024. Acid. No deposit. No albumen.

Uric acid in the 24 hours = 1·34 grain.
Urea, ditto = 306 grains.

May 12.—Urine, 32 fl. ounces. Acid.

Uric acid in the 24 hours = 0·76 grain.
Urea, ditto = 333 grains.

May 13.—Urine, 30 fl. ounces; sp. gr. 1025.

Uric acid in the 24 hours too small in quantity to weigh.
Urea, ditto =344 grains.

May 15.—Urine, 39·5 fl. ounces; sp. gr. 1018. Acid.

Uric acid in the 24 hours, a trace only.
Urea, ditto =358 grains.

Blood found to contain much uric acid.

Nearly four years after the above date, this patient's urine was again examined; at the time of the first analysis the gouty attack was passing off; when the second was made, he was quite free from active symptoms.

March 28, 1858.—Urine, 24 fl. ounces; sp. gr. 1024. Acid. Of an amber colour, and depositing yellow urates on cooling.

Uric acid passed in the 24 hours=5·20 grains.

April 8.—Urine, 48 fl. ounces; sp. gr. 1017; and giving rise to no deposit.

Uric acid passed in the 24 hours=1·36 grain.

Case 11. C. F., a male subject, aged 38. Suffered from numerous attacks of gout for ten years; the first few were confined to the feet; at present has small concretions of soda in the left ear, and also a semi-fluid collection of the same matter at the side of the left foot; some deposits also on the right little finger.

The urine was first examined for fourteen successive days, in January, 1854, the patient's symptoms at the time being very chronic, and the results were as follow:

Date.	Quantity, Fluid oz.	Sp. gr.	Reaction.	Physical Appearance.	Uric acid passed in 24 hours: grains.
Jan. 4	57	1012	Acid.	Clear.	0·50
,, 5	44	1013	,,	,,	0·05
,, 6	44	1013	,,	,,	0·00
,, 7	37	1012	,,	,,	0·14
,, 8	46	1011	,,	,,	0·00
,, 9	44	1011	,,	,,	0·00
,, 10	44	1012	,,	,,	0·71
,, 11	34	1014	,,	,,	0·09
,, 12	61	1013	,,	,,	2·40
,, 13	55	1012	,,	,,	0·00
,, 14	87	1009	,,	,,	0·00
,, 15	81	1011	,,	,,	0·00
,, 16	73	1015	,,	,,	0·00
,, 17	84	1014	,,	,,	0·00

The experiments were again repeated in February.

February 18.—Urine, 57 fl. ounces; sp. gr. 1012·5, at 60° Fahr. Acid. No albumen.

Uric acid eliminated in 24 hours = 1·22 grain.
Urea, ditto = 411 grains.

February 19.—Urine, 51 fl. ounces : sp. gr. 1014, at 60° Fahr.

Uric acid eliminated in 24 hours = 0·71 grain.
Urea, ditto = 392 grains.

February 20.—Urine, 74 fl. ounces; sp. gr. 1010, at 60° Fahr.

Uric acid eliminated in 24 hours = 0·69 grain.
Urea, ditto = 356 grains.

February 21.—Urine, 50 fl. ounces; sp. gr. 1015, at 60° Fahr.

Uric acid eliminated in 24 hours = 3·65 grains.
Urea, ditto = 384 grains.

The urine was once examined when this patient was under the influence of colchicum.

January 26.—Urine, 38 fl. ounces ; sp. gr. 1017, at 60° Fahr.

Uric acid eliminated in 24 hours,—no trace.
Urea, ditto = 288 grains.

The blood was found to contain much uric acid.

Case 12. C. F., a male subject, aged 35. Has had a few attacks of gout; some slight, but the last very severe indeed, and induced by a serious accident. Some small concretions of urate of soda noticed in the ears, and around some of the joints of the fingers. No acute symptoms present when the examinations of the urine were made.

Jan. 21	urine, 57 fl. oz.;	sp. gr. 1012	at 60° Fahr.	None of the specimens gave any deposit of uric acid when acidulated with hydrochloric acid, and allowed to stand 48 hours.
,, 22	,, 51 ,,	,, 1013	,, ,,	
,, 23	,, 59 ,,	,, 1014	,, ,,	
,, 24	,, 59 ,,	,, 1013·5	,, ,,	

The blood contained much uric acid.

Case 13. J. P., a male patient, aged 43. For eleven years has been subject to frequent attacks of gout, at first confined to one great toe and ankle; two small deposits of urate of soda seen on the cartilages of ears. No active symptoms present when the urine was examined.

Jan. 24, 1854,	urine 70 fl. ozs.;	sp. gr. 1012·	These three specimens acidulated with hydrochloric acid gave mere traces of uric acid.
,, 30 ,,	,, 52 ,,	,, 1011·	
,, 31 ,,	,, 58 ,,	,, 1011·	

The blood at this time was rich in uric acid.

After two years' interval, the same patient's urine was again examined, when recovering from a slight attack of gout, and when no active symptoms were present and no medicines were administered. The examinations were made chiefly to ascertain the amount of urea eliminated.

February	23,	1856.	Urea, in the	24 hours	=286	grains.
,,	24,	,,	,,	,,	=213	,,
,,	25,	,,	,,	,,	=304	,,
,,	26,	,,	,,	,,	=299	,,
,,	27,	,,	,,	,,	=359	,,
,,	28,	,,	,,	,,	=315	,,
,,	29,	,,	,,	,,	=302	,,
March	2,	,,	,,	,,	=312	,,
,,	3,	,,	,,	,,	=264	,,
,,	5,	,,	,,	,,	=262	,,
,,	6,	,,	,,	,,	=234	,,
,,	7,	,,	,,	,,	=287	,,

On several of the above days the urine was treated with hydrochloric acid, in order to ascertain the amount of uric acid; but on no occasion was sufficient quantity precipitated to collect and weigh; in fact, only a few microscopic crystals could be detected. The blood at the same time contained a large amount of uric acid.

Case 15. T. C., a male subject, aged 57. Gout of about twelve years standing; very large concretions observed upon the cartilages of the ears and in the other parts of the body.

September, 1854.—Urine pale, of low specific gravity, with a trace of albumen; when acidulated with hydrochloric acid, gave a mere trace of uric acid.

Blood contained much uric acid.

Case 16. R. W., a male patient, aged 53. Suffered from gout for fourteen years. The first and two subsequent attacks were confined to the ball of left great toe; other joints afterwards became affected. Has noticed deposits in ears for at least seven years. These are now very large, and numerous spots of urate of soda also seen on left lower eyelid; considerable chalk-like masses exist about the hands and elbows, which are thereby much deformed and crippled.

June, 1858.—Urine passed at 12 at noon, sp. gr. 1011; distinctly albuminous. Treated with hydrochloric acid, gave no trace of uric acid.

Case 17. T. F., a gentleman, aged 64. Has had gout for twenty years. At first confined to the ball of one or other great toe; and in course of years gradually travelling upwards. Is now suffering from chronic pains, and has some enlargement about the fingers; and one of these, on being punctured, gave exit to a creamy fluid, consisting of crystallised urate of soda. No deposit upon the cartilages of ears.

Urine, 80 fl. ounces; pale yellow; sp. gr. 1013.

No trace of uric acid when acidulated with hydrochloric acid.

On another occasion, the urine of this patient gave a moderate deposit of uric acid when treated in the same manner.

A glance at the foregoing analyses will at once prove the diminution of the uric acid in the urine of these patients to be most marked; for in no case did it exceed 5·78 grains, and this on one day only; the next highest number representing the elimination of uric acid is only 3·57 grains; and even such appeared to be on a very exceptionable day, the excretion of this principle being usually much smaller; in fact, the total average of all the analyses in the second class of cases is exceeding low, far under a single grain. Several urea determinations of these urines were likewise made; four in Case 10, where the quantities were found to be 306 grains, 333 grains, 344 grains, and 358 grains, giving an average of 335 grains for the daily elimination of this body; and it will be noticed, on looking over the details of the analyses, that, although the quantity of urea remains nearly constant and about normal in quantity, the uric acid is not only exceedingly deficient in amount, but subject to the greatest fluctuations, varying in the four days from 134 grains to a quantity too small to be collected and weighed. Again, in Case 11, four determinations of the urea give 385 grains as the daily average, with but slight difference between the mean and extremes, the uric acid during the same period exhibiting the same violent variations as in Case 10; varying from 365 grains to 0·71 grain, and on another occasion from 2·4 grains to 0·0 grain. In Case 14, the urea was determined, with one exception, on twelve successive days: the average was found to be 286 grains, the extremes being 213 grains and 359 grains. On several of the above occasions the amount of uric acid was attempted to be ascertained; but in no analysis was a quantity found sufficiently large to collect and weigh. From these observations it is evident, that in cases of chronic gout the function of the kidneys for excreting urea from the blood often remains intact, or almost so, at the same time, the power of the organ for the elimination of uric acid becomes most seriously impaired.

Another point of interest shown by these examinations is the fact of the very frequent presence of a small amount of albumen in the urine of chronic gout. In ten out of the seventeen cases it is asserted to be present; and it is possible that in some of the remaining seven it might have existed, as it is not always specially asserted that no trace was present. The quantity of the principle is not usually large, but sufficient to give a distinct haziness, when the urine is boiled with the addition of nitric acid, and also a notable precipitate after the tube is allowed to remain at rest for a short time.

In many cases of chronic gout besides those alluded to, I have observed the phenomenon; others also have noticed the same. The cases in which it is here recorded to have occurred are those in which a quantitative examination of the urine has been made, and form but a small per-centage of the patients which have come under my notice.

In conclusion, it may be stated that the more common appearances and characters of the urine in chronic gout, as shown by these and other examinations, are as follow.

It is usually rather pale, below the average tint of healthy urine, of lower density, and often increased in quantity.

The amount of urea, except in extreme cases, about the same as in health (due regard being taken of the diet of the patient at the time).

The uric acid very much diminished, and subject to excretion in very varied quantities at different times. Lastly, the presence of a small amount of albumen is exceedingly frequent.

The occurrence of deposits in the urine of these subjects is not very common; but they occasionally occur during the cooling of the fluid, sometimes in the form of urate of soda or ammonia, at other times as rhombs of uric acid, which are more or less coloured.

CLASS III.—*Urine of individuals who had suffered more or less frequently from attacks of Gout of varying degrees of intensity, examined at the time of complete freedom from the disease.*

CASE 1.—The first three analyses were of the urine of a gentleman, about 40 years of age, rather tall and stout, subject to occasional attacks of gout in the ball of the great toe, but no other joint ever affected; his health was otherwise good.

January 16, 1852.—Urine, 41·5 fl. ounces; clear, amber colour; acid; sp. gr. 1024, at 60° Fahr. Contains no albumen, and gives rise to no deposit on cooling.
Uric acid eliminated in the 24 hours = 4·72 grains.

January 17.—Urine, 43 fl. ounces; sp. gr. 1022. Acid. Gives rise to a light pinkish coloured deposit of urates on cooling.
Uric acid eliminated in the 24 hours = 6·50 grains.

January 21.—Urine, 47 fl. ounces; sp. gr. 1023. Clear, amber coloured. No deposit on cooling.
Uric acid eliminated in the 24 hours = 3·85 grains.

CASE 2.—A gentleman, aged 56. Has suffered from gout for many years, and has had the larger joints of the body affected as well as the great toe: no symptoms present when the examination of the urine was made.

February 12, 1851.—Urine, 60 fl. ounces; sp. gr. 1014, at 60° Fahr. Free from albumen.

Uric acid eliminated in the 24 hours = 4·26 grains.

A small blister applied at another period yielded a fluid which contained a considerable amount of uric acid.

Case 3.—M. C., a lady, about 38 years of age, who had suffered from atonic gout for many years, but free from external deposits of urate of soda, and from deformity or stiffness of joints. No symptoms of gout present when the urine was examined.

Urine, 42 fl. ounces; pale in colour; no albumen; sp. gr. 1019, at 60° Fahr.

Urea eliminated in the 24 hours = 373 grains.
Uric acid, ditto, no trace deposited.

Case 4.—J. L. R., a male subject, aged 48. Has suffered from three attacks of gout, the great toe being especially affected in each attack. No deposit of urate of soda visible either upon the cartilages of the ears or any other part of the body. This patient was free from all joint affection when the urinary examinations were made.

February 21, 1854.—Urine, 58 fl. ounces; sp. gr. 1015, at 60° Fahr.
Uric acid eliminated in the 24 hours = 2·93 grains.
February 23.—Urine, 88 fl. ounces; sp. gr. 1080, at 60° Fahr.
Uric acid eliminated in the 24 hours = 1·23 grain.
Urea, ditto, = 385 grains.
February 24.—Urine, 60 fl. ounces; sp. gr. 1014, at 60° Fahr.
Uric acid eliminated in the 24 hours = 1·82 grain.
Urea, ditto, = 335 grains.
February 25.—Urine, 77 fl. ounces; sp. gr. 1011, at 60° Fahr.
Uric acid eliminated in the 24 hours = 1·69 grain.
Urea, ditto, = 370 grains.
February 27.—Urine, 64 fl. ounces; sp. gr. 1013, at 60° Fahr.
Uric acid eliminated in the 24 hours = 0·19 grain.
Urea, ditto, = 338 grains.

When this patient's urine was quantitatively examined for urea and uric acid, it was clear and free from deposit; but at the time of the attack, which was very severe, the urine became turbid on cooling from the deposition of reddish coloured urates. No albumen was present at any period. The blood examined during the fit was found to contain much uric acid.

Case 5.—T. B., a male patient, aged 54, had suffered from numerous attacks of gout, chiefly in the great toe; no deposits of urate of soda were visible in any part. He was free from all symptoms, and had omitted medicines for some time before the examinations of the urine were made, but a few days afterwards he had a return of gout. The patient was allowed a moderate amount of meat.

May 11, 1854.—Urine, 60 fl. ounces; clear; acid; sp. gr. 1019.
Uric acid eliminated in the 24 hours,—a mere trace.
Urea, ditto, =372 grains.

May 12.—Urine, 54 fl. ounces; acid; sp. gr. 1017.
Uric acid eliminated in the 24 hours,—too small to collect and weigh.
Urea, ditto, =441 grains.

May 13.—Urine, 74 fl. ounces; sp. gr. 1015.
Uric acid eliminated in the 24 hours,—a mere trace.
Urea, ditto, =569 grains.

The serum of the blood examined during the attack was found to be rich in uric acid.

Case 6.—S. N., a male subject, aged 68. Had suffered for many years from repeated attacks of gout, chiefly in the great toes, but other joints have occasionally been affected. At the time the urine was examined was free from all symptoms.

February 21, 1854.—Urine, 55 fl. ounces; sp. gr. 1013.
Uric acid eliminated in the 24 hours = 1·93 grain.
Urea, ditto, = 317 grains.
February 22.—Urine, 50 fl. ounces; sp. gr. 1014.
Uric acid eliminated in the 24 hours = 2·28 grains.
Urea, ditto, = 312 grains.
February 23.—Urine, 44 fl. ounces; sp. gr. 1014.
Uric acid eliminated in the 24 hours = 1·60 grain.
Urea, ditto, = 275 grains.
February 24.—Urine, 29 fl. ounces; sp. gr. 1016.
Uric acid eliminated in the 24 hours = 1·48 grain.
Urea, ditto, = 234 grains.
February 25.—Urine, 40 fl. ounces; sp. gr. 1014.
Uric acid eliminated in the 24 hours = 2·72 grains.
Urea, ditto, = 269 grains.

This patient had taken small doses of the acetic extract of colchicum in the form of pill for several days previous to the 21st, and on the 22nd was ordered to omit them, on account of the occurrence of slight diarrhœa; this continued more or less till the 25th. From his own statement there was no loss of urine during that time.

It will be seen from the above analyses that in no one of the six patients did the amount of uric acid excreted in the twenty-four hours exceed the healthy average; in the majority it was far below. From these and other less complete examinations I am inclined to think that in individuals who have suffered frequently from gout, even though no visible deformity of the joints or deposits may have resulted therefrom, the kidneys lose to some extent their power of excreting uric acid; and moreover, I am convinced from the results of many trials, that the blood is often kept impure from its presence. This is probably one cause of the extreme liability of such patients to periodic visitations of the malady, and also of the great difficulty in effecting its radical cure.

It is likewise interesting to observe that in these individuals, as well as in those suffering from acute or chronic gout, the urea-eliminating function of the kidneys remains comparatively intact.

Microscopic examination of the Urine in Gout.—The urine of gouty patients sometimes exhibits microscopic characters of great value, more especially in arriving at a correct prognosis of the disease. In the early stages of gout occurring in individuals otherwise healthy, the information obtainable from microscopic examination of this fluid is of little moment. It may, perhaps, exhibit a deposit of urate of soda, varying in hue from a pale buff to a bright pink, or brick-dust red, and consisting either of amorphous granules, or masses, or groups of spiculæ; or there may be sediments of uric acid; or the two may be combined, as seen in Plate 6, fig. 1, and fig 2, *a*, *b*; but as these are frequently noticed in other diseased conditions, the information they afford is slight. When, however, the affection becomes chronic, and more especially when extensive deposits are forming around the joints, then other phenomena are frequently observed. Along with the small amount of albumen which we have found to be so common, casts of tubes are met with, generally of a granular character, as exhibited in Plate 6, fig. 6 *a*, and consisting of disintegrated epithelium, more or less moulded into the shape of the tubes. Sometimes these are seen during the acute exacerbation, but not in the intervals; such was the case with the urine of two patients recently under my care. This appearance of granular casts, indicates that a desquamative process is going on from the lining membrane of the uriniferous tubes, a change closely connected with deficient secretion of some of the elements of the urine, and more especially of the uric acid.

When the disease is still further advanced, a condition commonly evidenced, not only by the fearfully crippled state of the patient from chalky deposits, but likewise by the occurrence of other more serious symptoms, as epilepsy, paralysis, and coma, due to imperfect elimination from the kidneys, then not only does the urine become permanently, though perhaps slightly albuminous, but the granular casts are more or less replaced by others

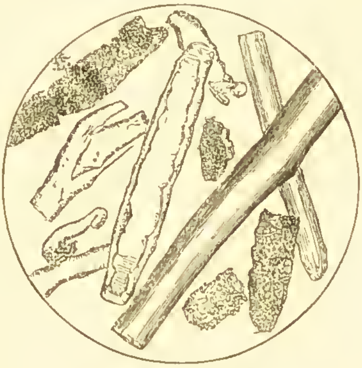


Fig. 11.*

---

* Fig. 11. Casts of tubes, some granular, some waxy or fibrinous in character, drawn from a specimen kindly lent by Dr. G. Johnson. Linear magnifying power, 220.

of a waxy, or fibrinous nature; these forms are seen in fig. 11, mixed with some of the granular variety.

Several of the cases illustrative of chronic desquamative nephritis, related by Dr. G. Johnson, were of patients the subjects of chronic gout.

In the latter stages of gout, copious deposits of uric acid, or urates, are not often met with, and the urine becoming much brighter and more normal in appearance, usually impresses the patient with the idea that an improvement in his state of health has commenced, whereas, in fact, it is an indication that the excreting power of the kidneys has become deficient, at least for uric acid.

We have already alluded to the intermittent manner in which the uric acid is sometimes eliminated in gouty cases. For days, scarcely a trace may be thrown out, and then suddenly such an amount as to be rapidly deposited in a crystalline form, when the urine is allowed to cool. Lastly, oxalate of lime is of frequent occurrence in the urine of gouty patients, but as it is found in so many other cases, its presence is of no value as a diagnostic mark. More commonly it is found in octahedra, rarely as dodecahedra, and occasionally in the dumb-bell variety, as shown in Plate 6, fig 3, *a*, *b*, *c*.

CHAPTER VI.

THE MORBID ANATOMY OF GOUT :—GREAT IMPORTANCE OF THE SUBJECT —CHANGES IN THE JOINTS OBSERVED BY MORGAGNI, DR. MONRO, AND OTHERS—SIR B. BRODIE'S DISSECTION OF A GOUTY SUBJECT—CRUVEILHIER'S OBSERVATIONS—THE AUTHOR'S INVESTIGATIONS —1. OF CASES OF CHRONIC GOUT WITH EXTENSIVE CHALK STONES —2. OF SUBJECTS EXHIBITING POINTS OF DEPOSITON ON THE EARS ALONE—3. WHERE NO DEPOSIT OR DEFORMITY EXISTED—4. WHEN ONLY THE BALL OF ONE GREAT TOE HAD BEEN AFFECTED WITH GOUT.

IT is commonly remarked, in works devoted to the consideration of gout, that morbid anatomy has effected little towards the elucidation of the nature of the disease; that although alterations of structure have been found in many cases, still these have been insufficient and too much wanting in constancy and precision to be depended on. I hope, however, to be able to show that at the present time this remark no longer holds good; and that the study of the nature of those changes, which I shall demonstrate to be constant in all cases of the disease, is sufficient to afford considerable insight into the intimate pathology of gout. Considering this part of the subject of the highest importance, I shall not hesitate to devote some considerable space to its investigation, and shall endeavour to present to the reader all that is important concerning it, some portion of which has only been satisfactorily proved within the last few months—I allude especially to the early changes of structure in the joints, and to the frequent or almost constant affection of the kidneys.

It has been long known that changes in and around the joints occasionally ensue in gout, and that such consist in the deposition of a chalk-like matter, principally composed of urate of soda ; but this occurrence has generally been looked upon as rather exceptional, and only met with in individuals who have suffered from the disease in its most inveterate and protracted forms, and no idea was entertained that any necessary relation existed between gouty inflammation and such depositions.

M. Portal, in his "Anatomie Médicale," assures us he has seen the synovial secretion of the consistence of jelly, or even sometimes so thick as to have the appearance of plaster ; he also observed, after prolonged and severe gout, the bones of the feet covered with this white matter. Morgagni relates the same in his account of the examination of the joints of a Venetian nobleman.

Dr. Monro, jun., in his "Outlines of Anatomy," remarks, "The extremities of the bones of the feet and hands have been said to be occasionally converted into a white substance like chalk in persons who have been long afflicted with gout," and in the first volume of the Medical Communications, 1782, Mr. Henry

Watson relates the appearances found in the body of an extremely gouty subject, a Mr. Middleton, commonly known by the name of Whig Middleton; the most important points of his examination are as follows: — One of the great toes was much enlarged, and on dissection the ball or first joint was found, as if encased in a bed of chalk, like a fossil shell, but the bone itself was neither increased in size nor altered in structure. The joints of the fingers were also swollen and knotty, each knot being a lump of chalk; and when he played at cards, he used frequently to score up the game with his knuckles. On the middle of the right tibia there appeared an oblong tumour resembling a node, over which the integuments were very thin and ready to burst; it was a mere deposition of chalk between the skin and periosteum, and though thick and large, had not as yet done any injury to the bone.

Mr. Middleton had complained of excruciating pains in his head, often imagining he was tumbling headlong; this was especially a little before his death. The dura mater was found indurated, the substance of the brain firm, with a clear fluid in the ventricles; the pia mater was pale, and on its outer surface was a cream or smooth chalk-like mucus. The heart was healthy, and also the thoracic aorta; the aorta, however, was ossified from the diaphragm to the iliac arteries. The kidneys were much diminished in size, and contained hydatids, and the outer surface of the right studded with little bladders. No calculi or chalk were observed in the kidneys or urinary bladder.

The synovial fluid found in the joints of the lower extremities was as thick as cream, like a mixture of chalk, oil, and water, but the cartilages were not much altered.

In the lobe of one lung a small stone was discovered, and the tracheal glands were filled with white matter.

It must be borne in mind that Mr. Watson was not at all aware of the nature of the chalky substance above spoken of, and had no power of chemically distinguishing deposits of urate of soda from those of carbonate and phosphate of lime; and therefore we have no proof that the white matter in the bronchial glands and the small stone in the lung contained uric acid, or were in any degree related to the deposits in and around the joints, or had any connection with the gouty disease.

Sir B. Brodie, in 1812, made a dissection of an old lady who had suffered in an unusual degree from gout for a great part of her life, and the principal points of interest, in connection with the present subject, are given below. Several joints of the fingers were anchylosed, the fingers themselves being variously distorted; the middle finger of the left hand was shortened, and the skin over it loose. The bone of the second phalanx appeared to have been nearly absorbed, so that scarcely any of it remained: and only a small quantity of a soft substance occupied its place. The right wrist and elbow were anchylosed, as were also several joints of the toes. The knees admitted of incomplete flexion and extension; and the motion of the joints was attended with a grating sensation. In various parts of the body there were orifices in the skin communicating with membranous cysts, situated in the adipose substance, and discharging a chalky liquid. There were no remains of the cartilages in the left knee. The corresponding parts of the patella and condyles of the femur had the appearance of having been worn into grooves and ridges, as if from friction on each other; presenting, however, a compact surface, the cancellous structure not being exposed, as would have been the case if friction had been carried to the same extent in the dead body. A thin layer of white chalk-like matter had been deposited on the bones in several places where the cartilages had disappeared. On the margin of the articulating surfaces were several small exostoses. The ligaments and synovial membrane were little altered from their natural state, with this exception, that the thin layer of the latter, which is extended over the cartilages, had disappeared with the cartilages themselves. In the right wrist the first row of the carpal bones were anchylosed to each other and to the radius. The other joints were not examined.

The above case was published in Sir C. Scudamore's work on Gout, many years since, and is also contained in Sir B. Brodie's valuable volume on Diseases of the Joints, in which latter are also found details of other and similar cases, from which the author remarks that lithate or urate of soda is deposited in a variety of textures: "Underneath the synovial membrane, on the bone, near the margin of the cartilage; on the surface and in the substance of the cartilage; in the cancelli of the bone, and in the cellular tissue external to the joint."

Cruveilhier, in his "Anatomie Pathologique," has given a plate delineating some of the appearances observed in the joints of a patient suffering from chronic gout. In a knee-joint the condyles of the femur were covered with the plaster-like substance which is said to penetrate to the bone, and the same matter is also noticed on the synovial fringes, which were more than ordinarily developed. The articulating surface of the patella had the like deposits arranged more or less linearly. On the anterior surface of the patella, two sub-cutaneous synovial capsules were found, the walls of which were thick and cartilaginous, and sprinkled throughout with white points, and the contained liquid had the appearance of chalk and water; the fibrous layer covering the patella, as also the various tendons of the muscles, were similarly affected.

In the ankle joint a like incrustation was observed, and deposits likewise found in the two lateral and posterior ligaments; the lateral, as well as the superior surface of the astragalus, were also covered with the white matter.

On making a section of the astragalus, Cruveilhier observed within the substance of the bone, and at a small distance from the cartilage, little cretaceous masses, which he had also noticed near the calcanean surface of the bone, the neighbouring cartilage being in a perfectly healthy condition; the so-called cretaceous matter was evidently supposed by Cruveilhier to be of the same nature as the substance on the cartilages themselves. Small masses of deposit were likewise seen in the adipose cellular tissue, which covers the plantar and lateral faces of the os calcis, and also in the tendo Achillis. In the foot some of the articulations, as the astragalo-scaphoidean, and calcaneo-cuboidean, and astragalo-calcanean were either healthy or nearly free from deposit; others, as those of the scaphoid bone, with the three cuneiform and cuboid bones, and the cuneiform bones among themselves, much more incrusted. The metatarso-tarsal articulations, more or less, the first and last being more freely covered than the intermediate ones. The cartilages of the metatarso-phalangeal joint, or ball of the great toe, were much crusted; and surrounding the articulation the same occurred to even greater extent. Both around the metatarsal bone and phalanges, linear deposits of chalky matter were seen on the periosteum: the phalangeal articulation was anchylosed, and the cartilages apparently destroyed from deposition. The tendon of the flexor longus pollicis was covered with the concretion on both surfaces, as also the ligaments surrounding the great toe.

The thumbs and little fingers were more or less similarly affected, but the intermediate fingers were very slightly implicated, some scarcely at all. The joints of the upper extremities presented similar alterations, the subcutaneous capsule of the elbow contained a plaster-like matter, the joint itself being healthy; but along the course of the biceps muscle, in the cellular tissue of the fold of the arm, and even within some of the muscles, chalky concretions were found in the form of small non-coherent grains.

The following, also given by Cruveilhier, is an account of the examination made by M. Fauconneau Dufresne, of a gentleman formerly a captain in the army, aged 50; who had suffered from gout for many years, but who died from the exhaustion induced by dysentery.

Numerous ulcerations were found in the colon increasing towards the lower part of the bowel, but nothing else remarkable in the remaining abdominal viscera. The joints presented the following peculiarities:—

Left knee joint.—All the internal surface of this articulation was covered with a layer of white matter, rough and unequally marked with numerous furrows, which in some places allowed the bone to be seen; in others, this layer was removed by moderately firm scratching, showing the cartilage beneath intact; in the latter case it appeared to be deposited between the healthy cartilage and the synovial membrane. Some parts of the articular surface were free from it; its thickness varied from half a line to two lines. This matter was friable, possessing the physical properties of dried plaster. The anterior or external surface of the patella was covered with this matter, about a line or line and half in thickness, situated between the bone and the fibrous layer which covers its anterior surface; beneath it the patella appeared to be considerably injected, but this was found to be entirely superficial in character. On making a section of the patella, the same deposit was seen of the form and size of a nut, but somewhat flattened in the centre of the bone itself. This internal deposit was found to be altogether disconnected with that on the surface of the bone. Beneath the patella, and internal to the ligament, was a cyst, of the size of a nut, filled with a reddish liquid in which were floating a quantity of small grains, which appear to be the matter above described, in a state of very fine division, giving the contents the appearance of cement. All along the ligament, in the spaces between the fasciculi and the fibres, the same substance was also found which had separated, and, as it were, dissected them out. The fibres themselves were in no way altered in structure. The right knee joint, presented on the external condyle, a layer thicker than that on the left—beneath it the osseous substance was rough and worn.

The tibio-tarsal articulations had a very thin and smooth layer, which appeared deposited between the cartilage and the synovial membrane. In front of the articular surface of the tibia, between the bone and the ligaments, was a layer of the thickness of the thumb. The tarsal articulations, and the greater part of the tarso-metatarsal and the metatarsal articulations were anchylosed. White lines marked the position of their junction, and the chalky matter was deposited in small masses around.

The metatarso-phalangeal articulation or ball of the great toe was filled with a grumous semi-solid chalky matter. The cartilages were destroyed, the surface of the bone was rough and very red, and the spongy extremities infiltrated with the same. The other matatarso-phalangeal and the phalangeal articulations preserved their mobility, but had a thin layer of plastery matter deposited beneath the synovial membrane. Small hard cretaceous matters were observed external to these articulations. Two articulations of the last phalanges were healthy.

The elbow-joint.—The articular surfaces were covered with a smooth chalky deposit, and there was present a similar incrustation of the surrounding fibrous parts. The tumour of the right elbow was formed of a creamy white matter, made of numerous cretaceous grains. In the radio-carpal articulation there was a thin layer of the same nature. The bones of the carpus were soldered together; thick chalky incrustation and soldering in the carpo-metacarpal articulations, and infiltration of grumous plaster into the areola of the bone. Simple incrustation of the phalangeal articulations, and around them chalky masses had formed, constituting the nodosities observed during life. The tendons of the flexor muscles contained in their substance numerous small chalky grains deposited between the fibres. There was also a considerable quantity of the same in the fibrous sheaths of the fingers.

Coxo-femoral articulation, or hip-joint.—In both the head of the femur was natural. In the left cotyloid cavity chalky matter was deposited in the form of small isolated spots, the cartilage being intact. The capsular ligament was infiltrated in the form of lines and points. The right cotyloid cavity was covered with a thin and smooth layer allowing the healthy cartilage to be seen beneath it. The synovial fringes of the two cavities very thick and red. Around the articulation on the os ilium and the femur, there were small cretaceous masses, which appeared to be deposited on the surface of the periosteum.

Each scapulo-humeral articulation or shoulder-joint, offered only a few spots and points of cretaceous matter. There were some grains in the articulation of the symphysis pubis, and in the intervertebral substances, as likewise in the transverse-costal and the temporo-maxillary articulations. In the midst of the posterior muscles of the thigh, there was a mass of cretaceous matter the size of a nut, surrounded with cellular membrane. On the internal surface of the thigh between the aponeurosis and the muscles was a layer of cretaceous matter six lines in thickness. In the right *ear*, between the skin and the cartilage, small grains were also apparent.

Other similar but more recent dissections of gouty joints might be cited, as noticed by Dr. Todd in his lectures, and Dr. W. Budd and Dr. Bence Jones in the Transactions of the Medico-Chirurgical and Pathological Societies; but it is unnecessary, as no further light would be thrown upon this part of our subject by their aid; it will be seen, however, from the description of the individuals in whom the examinations were made, that they had been subjects of the disease in its most inveterate form, and for lengthened periods of time. Many of their joints had become crippled, and they had extensive chalky deposits. The results arrived at from the above examinations, as far as the changes in the articulations are concerned, may be thus summed up. In many cases of severe and protracted gout, deposits of chalky matter (urate of soda) occur around the joints, upon the surface of the fibrous tissues and within their structure; the synovial fluid of the cavities becomes thick, and now and then even of the consistence of plaster; the joints are either partially or completely anchylosed by the rigidity of the surrounding ligaments, and some of the smaller ones, especially the great toe, occasionally so completely surrounded with deposits as to exhibit the appearance of being inclosed in a bony or chalky case. As before observed, the dissections hitherto given have been confined to gouty subjects who had suffered from the disease in its most severe and protracted forms; from such alone we should be quite unable to arrive at any definite conclusion as to the occurrence of changes during gouty inflammation, which are both constant and pathognomonic. Considering this a most important point to determine accurately, I have for a long time devoted much attention to its consideration, and have recently been enabled to elucidate satisfactorily the real nature of these alterations.

In order to render the subject as clear as possible I will shortly lay before the reader the results derived from numerous autopsies of gouty cases; some have died during the presence of gouty inflammation, most however in the intervals, from accidents or maladies totally independent of the one in question; and in commenting upon these I shall at first direct my remarks to the alterations seen in and around the articulations, and afterwards proceed to treat of the changes in other organs and structures.

I.—*Examination of subjects of Chronic Gout, with extensive chalk-stones.*

Case 1.—1855. W. M., a man who died at the age of 55 years, a compositor by trade, and not known to have any hereditary predisposition to gout, but a brother had suffered from the disease; he had formerly indulged in malt liquors and spirits, and altogether lived rather freely. About fifteen years before his death had the first attack of gout confined to ball of the great toe; after a time, the disease became more general, gradually creeping upwards until at last nearly all the joints of the body had become implicated;

deposits of urate of soda had been observed for many years upon the cartilages of the ears, and likewise around many of the smaller joints, especially of the hands; some of these had approached the surface and had been discharged by ulceration. Many of the articulations were anchylosed and otherwise deformed, and some of the bursæ, especially that over the left olecranon process, were much distended from deposition of chalky matter, the elbow however was less swollen than that represented in Plate 2. Albumen had been detected in his urine for some considerable time, with granular and waxy cysts, and of late these had much increased and had been accompanied with some edema of the lower extremities. The cause of his death appeared to have been exhaustion from the almost constant presence of gout in one or more joints, hastened by a severe shock to his nervous system.

On opening the left knee-joint, a thick synovial fluid was found, which on close examination exhibited minute white specks, crystalline in structure, and consisting of needles of urate of soda. (Plate 5, fig. 3.) The condyles of the femur were extensively covered with the deposit, not simply arranged in streaks, but occupying a large amount of their surfaces, except at the outer margin, or in the situation of the synovial fringes; the surface of the tibia was covered, but the white matter was less freely deposited here than on the femur; the articulating surface of the patella was likewise incrusted.

The appearance presented when the joint was first examined, is well seen in Plate 3, fig. 1, *a*, *b*, *c*, a drawing taken from a wax model made at the time. The synovial membrane was very vascular, and numerous white granules could be observed and felt upon the surface, consisting of the same salt, urate of soda. Deposits were likewise found on the crucial ligaments and fibro-cartilages. The right knee joint exhibited in every respect the same peculiarities as the left; all the articulating surfaces being freely covered with the deposit, as well as the fibro-cartilages and ligaments. The same changes were observed in the synovial membrane and contained fluid.

Many other joints were partially examined, as the elbow-joints, also several of the carpal and metacarpal, tarsal and metatarsal, and phalangeal articulations; and for the most part the surfaces were covered with a white coating, urate of soda. The ball of each great toe was completely incrusted.

The kidneys weighed respectively 2¾ and 3 ounces, avoirdupois; were pale and contracted; the cortical portion shrivelled, points and streaks of white matter seen at the apex of each pyramid, and running up in the direction of the tubuli.

The appearances exhibited by the right kidney, both externally and after section, are shown in Plate 4, fig, 2, *a*, *b*.

Case 2.—J. P., about sixty years of age, a strong-looking man, six feet in height, had been a gouty patient for many years, with chalky deposits upon the cartilages of the ears, and around many of the joints, some of considerable size. Death was occasioned by an accident.

Many of the joints were coated with white matter, in a manner described in the previous case. The kidneys were found much contracted, each weighing rather less than three ounces, and exhibiting the deposition of urate of soda upon the end of each cone, and along the direction of the tubuli.

Cases 3.—I have examined several of the smaller joints of subjects of very inveterate gout, which exhibited upon their surfaces evidence of the deposition of the chalk-like matter, and have made sections of these in various directions, which have enabled me to trace their deep-seated origin.

Plate 3, fig. 2, represents a horizontal section of the thumb, illustrating the manner in which the deposits take place, and the cause of the stiffening of the joint and subsequent anchylosis. It will be observed that a considerable amount of the chalky matter has been infiltrated into the ligamentous structures around the phalangeal joints, which alone must necessarily produce great crippling.

On carefully examining the drawing, it will also be seen, that the articular surfaces of the cartilages are not adherent, or glued together by such white deposit, but that a cavity can be shown to exist, the matter being apparently deposited on the free surfaces of the cartilages, and not penetrating their whole thickness; the same appearance is also presented in the phalangeal joints of the fingers in fig. 3 of the same plate, where the disease is advanced to an extreme degree; for here not only are the ligaments around the small joints affected, but deposition has also taken place within the sheaths of the tendon, in the tendons themselves, on the periosteum, and to such an extent as to produce complete rigidity of the whole finger, and the external bulging of the deposits, which is rendered visible through the skin. Many of the above mentioned tissues appear to be almost entirely converted into a chalk-like matter, and in fig. 3 it will also be observed, that a small quantity of urate of soda is seen within the substance of the bone of the first phalanx, and this is almost the only instance in which I have met with it; but even here the deposition within the osseous tissue seems to be in immediate connection with the same matter in the articular cartilage.

As Cruveilhier stated that small cretaceous masses sometimes exist in the substance of the bone itself, for example, in the astragalus, and quite removed from the cartilage, I have, with a view of testing this point, made numerous sections of bones taken from different gouty subjects, whose surfaces were completely incrusted, but in only two cases was I enabled to detect the slightest traces of urate of soda.

I consider this a question of some importance, and as having a close relation to the pathology of the disease; for I believe the deposition of the chalky matter can scarcely take place in a very vascular tissue, or, at any rate, in one whose circulation at the time is active. The amount of deposit in the finger (fig. 3), is so extensive that the blood-vessels must have been considerably pressed upon, and probably the circulation in the part was very defective, and, as above alluded to, the cretaceous-looking mass in the metacarpal end of the bone was immediately adjacent and in contact with the cartilage, which was itself completely infiltrated. I have chemically examined bones thus circumstanced, but could never detect a trace of uric acid in their substance when denuded of the diseased cartilage.

There are on record analyses of the bones of subjects of chronic gout, some of whom were stated to have had tophaceous deposits about the joints; one was made by Marchand of the upper part of the femur, and of the radius and ulna of a person with abundant chalk deposits on the knees and elbows. The results of his examination were as follow:—

	Femur.	Radius and Ulna.
Phosphate of lime	42·12	43·18
Carbonate of lime	8·24	8·50
Phosphate of magnesia . . .	1·01	0·99
Animal matter	46·32	45·96
Fluorides of calcium, sodium, chloride of sodium, and loss .	2·21	1·37

Lehmann also analysed the bones of three persons with chronic gout; their ages varying from 40 to 50 years. He found:—

	1	2	3
Phosphate of lime	35·16	35·83	37·22
Carbonate of lime	8·41	9·82	8·99
Phosphate of magnesia	1·31	1·05	1·13
Soluble salts	2·93	2·03	1·82
Cartilage	38·14	38·26	40·03
Fat	12·11	13·37	9·15

It will be seen that no uric acid is stated to have occurred in these bones, thus agreeing with my own observations; and the chief difference between them and healthy bones, appears to have consisted in the diminished quantity of earthy matter, and the large augmentation of the fat. Although I have not quantitatively determined the amount of fat in the bones of patients who have died from aggravated forms of gout, still I am convinced that this substance often exists in very large quantities; whether, however, this change is related essentially with this disease, or merely dependent on a depressed condition of body which then occurs, requires further observations to determine; for it seems that other tissues besides the bones are apt in such cases to become the seat of fatty degeneration.

There is one point in connection with the mode in which gouty deposits take place, pointed out by Dr. W. Budd, and which has a considerable bearing upon the pathology of the disease, or at least of the local manifestations of gout; namely, that urate of soda appears to avoid the contiguity of blood-vessels. Dr. Budd says, that in the larger cartilages, such as those of the knee-joint, immediately under the synovial membrane, and at the point where this membrane becomes attached to the border of the cartilage, there is a rich network of blood-vessels. From this network a series of straight vessels arise, which pass to a certain distance over the free surface of the cartilage, forming loops, which often present considerable dilatations. Now, wherever these vessels extend, the gouty matter is either very scanty or altogether absent. A margin of free cartilage surrounds them on all sides, so that the deposit seems, so to speak, to recede before the blood-vessel. This is clearly shown in Plate 3, fig. 1, *a*, where the mode in which the deposit has taken place on the surface of condyles of the femur, is depicted.

All chalk-stones probably have their origin in fibrous or cartilaginous structures; and are, I believe, never primarily connected with highly vascular tissues, although by increase of growth and the pressure thus induced, they may subsequently pass through these and appear on the surface of the body; they are most commonly first externally observed in parts of the body where the fibrous structures approach nearest the surface; as, for example, in the ears, on the palmar surfaces of the tips of the fingers, and in like situations; and it will be seen by reference to the drawing in Plate 3, fig. 3, how readily deposition in such parts must become visible.

The same remarks especially apply to the white specks so frequently seen on the ear, and which are equally connected with fibro-cartilaginous tissue.

II. *Examination of subjects of Gout, with no appreciable deformity, and no visible deposits of chalk-stones, except one or more specks on the cartilage of the Ear.*

Case 4.—The subject of the first case of this character was a man about 50 years of age, with whom I was unacquainted during life. He was tall and strongly made, and had died of some acute disease. There were no appearances of any deformity of the joints, the movements of which seemed to be performed with tolerable ease, and with the exception of three small nodules of urate of soda, upon the edge and fold of the helix of the right ear, no other deposits were discovered in any other external parts of the body.

The ear being more closely examined, the nodules were observed to be attached to the fibro-cartilage, from which they bulged outwards, separating the integuments from the cartilage; it was exceedingly difficult to detach them from the fibro-cartilage, as they appeared to penetrate into the very substance of that tissue. Under the microscope the white matter exhibited the crystalline appearance before alluded to (Plate 5, fig. 3), and consisted of urate of soda, united with the elements of the structure in which it was imbedded.

Each kidney was small, under three ounces avoirdupois, much contracted in size; on section, the cortical matter was found to be very deficient, and many white streaks of urate of soda were seen in the tubules of the pyramids; appearances which will be more fully described further on.

As there was so complete an absence of deformity in this subject, and merely the presence of a few small nodules of chalk upon the ears, it was a matter of considerable interest to ascertain the condition of the joints, in order to discover whether deposits of urate of soda take place upon the ligaments and cartilages of the articulations, when external appearances would not indicate their presence. The left knee was first examined; there were small patches of deposit upon the surface, and in the substance of the ligamentum patellæ, in fact in all the tendinous structures of the joint; in the former these spots were seen on the anterior or superficial layer, extending through to the surface of the bone; the patella itself was quite free from this matter, although sought for by making sections of the bone in various directions; the cartilage on the surface of the patella, which is turned inwards and forms part of the articulation, was of considerable thickness, and sprinkled on its surface and throughout its substance with small white points, some of the spots in the substance not being connected with those on the surface.

The articular surface of the femur was marked on both condyles with a small amount of plastery deposit, apparently smeared in streaks over the surface of the cartilage, but not at all extensively covered; shown in woodcut, fig. 12. The tendons at their point of insertion into the condyles of the femur, were also incrusted, especially on the surface corresponding to the small indentations in the condyle of the bone. The semilunar cartilages were freely spotted with the deposit; and the surfaces attached to the tibia, were thickly coated. The anterior and posterior crucial ligaments were whitened externally; and on section, presented in their interior large quantities of this deposit. The articular surface of the tibia was streaked in a similar manner to that of the femur, but less extensively. Some spots also existed in the articular surface between tibia and fibula.

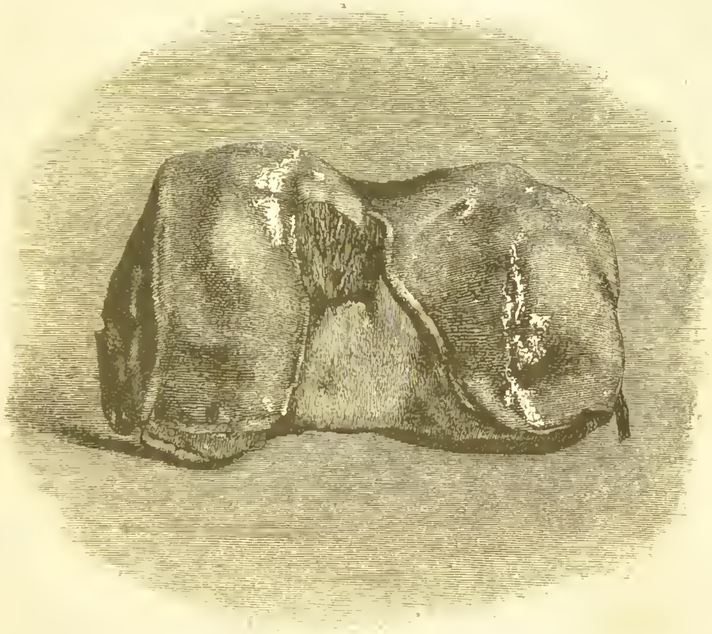


Fig. 12.*

---

* Fig. 12 represents the end of the femur, showing the deposition of urate of soda in streaks upon the surface of the condyles. No chalk-stones were visible externally, except two or three small spots on the cartilage of one ear.

The right knee was affected in the same way as the left. The appearance of the deposits of urate of soda in the knee just described, resembled somewhat that delineated in Plate 3, fig. 1, *a*, *b*, *c*, only the deposit was very much less in quantity.

The upper extremities exhibited the following phenomena: There was no deposit in the sheath or in the tendons passing from the forearm to the hand and supporting that articulation; the anterior and posterior ligaments themselves were sprinkled with a tolerable amount, passing from the surface to the inter-articular cartilage of the joint.

A small nodular deposit existed on the external surface of the styloid process of the ulna; the articular cartilage between the radius and ulna was covered with white urate deposit on both surfaces, so also were the articular cartilages corresponding to the wrist joint both on the carpal and radio-ulnar portions; over these surfaces it existed in very much larger quantities than in the knee joints. The fingers were variously affected; in some the sheaths of the tendons were the seat of the deposit, the tendons themselves being completely free; in others, as the index fingers, one joint had the articular cartilage and tendon free, another the surface healthy but the tendon with a very slight deposit on its surface; upon the whole, the tendon and ligaments, especially those around the joints and at the points of insertion into the heads of the phalanges, were more generally affected than the articular cartilages themselves.

The ligaments connecting the carpal bones to one another and also to the metacarpus, and likewise the carpal ends of the metacarpal bones, especially on their dorsal surfaces, appeared to be one mass of chalk-like concretion.

Carpus.—All the articular surfaces of the cuneiform, semilunar, and scaphoid bones were covered with a layer of white matter, which penetrated and incrusted all the ligaments uniting these bones; the ligament connecting the semilunar with the scaphoid was one mass of this matter; the cartilage on the surface of the cuneiform articulating with the pisiform bone was also implicated. All the cartilages of the articular surfaces of the unciform, os magnum, trapezium, and trapezoid, and the corresponding surfaces of the first row of carpal bones were more or less covered, those of the unciform and os magnum particularly so. The articulating surfaces of the second row of carpal bones with the metacarpal were still more uniformly and thickly covered, likewise the carpal surfaces of the metacarpal. The sheaths of the flexor tendons, also the tendons themselves, were superficially incrusted, and, in places, the plaster-like matter extended into the substance of the tendon.

The following were the appearances seen in dissecting one of the fingers of this subject, in which the disease had not made great ravages, as some of the cartilages were unaffected and others very partially injured.

The cartilage of the metacarpo-phalangeal joint appeared quite healthy, but at the point of attachment of the lateral ligaments, a small amount of the white deposit was observed on each side.

The surface of the first phalangeal joint was partially covered with a thin layer, but much healthy cartilage was visible, and chalk-like deposit existed in considerable amount at the point of attachment of the lateral ligaments with the bone. The same phenomenon was seen in the second phalangeal joint; the tendons in the finger were found healthy, but many spots of matter were seen upon the sheaths.

The great toe joint was found to be extensively diseased, the articulating cartilages being completely covered, as also the surrounding ligaments, so as to form in fact a complete solid case.

Several joints in this subject were perfectly healthy, for example, both hips and shoulders, and the left elbow; but the elbow joint on the right side showed considerable incrustation of the cartilages of the humerus, ulna and radius.

In most of the affected joints there was some thick white and opaque synovial fluid, which when put under the glass exhibited a crystalline appearance from containing much urate of soda. (Plate 5, fig. 3.)

Case 5.—Last year I had an opportunity of making an examination of the body of a gouty man, who did not present to ordinary observation, any appearance indicating the presence of chalky deposit.

The following is a short history of his case, taken during life. About 44 years of age, stout, of moderate height, with no hereditary predisposition to gout from either side; had always lived well, and drank rather freely of porter, occasionally mixed with gin; had been exposed to some hardships, and was laid up with yellow fever in Spain. The first fit of gout occurred twelve years before his death, in the ball of one great toe, the second a year after in the same locality; since the latter date he has had several attacks in which the ankles, knees, elbows, shoulders and hips, have been affected; his death was very sudden and depended on cardiac disease; the heart after death was found to weigh nearly fourteen ounces, and there was evidence of much fatty degeneration of its tissue.

During life this patient was free from any stiffness or deformity of joints, and no concretions were visible, saving two or three very minute points on the helix of the left ear, none of which were so large as the head of the smallest pin; in fact, so small were they, that only a most minute and special search would have enabled any one to discover their existence. The post mortem inspection gave the following results in reference to the joints.

The surfaces of the bones in the metatarso-phalangeal joint of both great toes were found completely covered as if with white paint; there was also some redness of the synovial membrane. The right knee-joint which had been recently inflamed, exhibited much vascularity both of the synovial membrane and fringes. The synovial fluid had a distinct acid reaction, and was speckled here and there with white points.

The outer condyle of the femur was streaked with white patches, the inner also, but in a somewhat less degree; the portion of the surface of the condyles in contact with the synovial fringes was completely free from deposit. The articular surface of the patella was irregularly spotted with the same, covering about one-third of the whole. The head of the tibia was streaked similarly to the femur, and the surface corresponding to the outer condyle of the femur had more white deposit than the rest. The fibro-cartilages were found strongly infiltrated, and spots of urate were also visible upon the crucial and other ligaments. The synovial membrane throughout the whole joint was finely sprinkled with very minute white granules; the nature and structure of which will be described further on.

The left kidney weighed two ounces and a quarter, was notched and contracted; the removal of the capsule caused some injury to the cortical portion, which latter was distinctly wasted. At the mamilla of each pyramid white points were observed, and streaks of the white matter seen in the pyramidal portion.

The right kidney weighed three ounces and a quarter, and in all respects exhibited the same appearances as the left. The heart was somewhat enlarged, some atheromatous deposits were seen on the aortic and mitral valves, and much fat in its muscular fibres.

3. *Examination of subjects of gout, in whom no trace of chalky matter was externally visible in any part, and in one case eight attacks only of the disease had occurred.*

Case 6.—J. S., a male subject, about 52 years of age, with whose previous history I am unacquainted. His body presented no deformity in any part, and there was an absence of rigidity of joints, except of the metatarso-phalangeal articulation of the right great toe; not the slightest appearance of chalky deposit was visible, although carefully sought for, the ears being specially examined. The joints of the upper extremities were found to be healthy, even the smaller articulations of the carpus, metacarpus, and phalanges; the same was the case with the hip-joints; but in the knees and below, the articular cartilages were rather freely incrusted with urate of soda; such was the case with the surfaces of the femur, tibia, and patella, in the knee-joints, with almost all the surfaces of the bones of the tarsus and metatarsus, and with some of those of the phalangeal articulations. The ball of the right great toe was anchylosed by the large amount of deposit in the surrounding ligaments, and a mass of considerable size was found to penetrate into the substance of the first phalanx. The astragalus, os calcis, tibia, and femur exhibited no appearance of this matter in their structure, but the tissue was soft and affected with fatty degeneration.

The synovial fluid appeared healthy, no crystals were visible in it; but the membrane of the knee-joints showed a fine sprinkling of white points of urate of soda. Some of the toes were carefully examined, in order to ascertain the exact point where deposition first takes place in joints. In no case was it observed in the ligaments where the articular surface was not also implicated. The kidneys were small and shrivelled. Each weighed three ounces avoirdupois. The removal of the capsule caused injury to the cortical portion, which had become wasted. At the apex of each cone white points were observed, and streaks of the same matter were seen to radiate in the direction of the tubuli.

Case 7.—I am indebted to my friend Mr. J. Clover for the following observations, which were particularly valuable to me, being the first made on a gouty subject who presented no deformity or external deposits of chalky matter.

J. T., a gentleman aged 75, who had suffered from gouty attacks for thirty years, but in whom the disorder had never assumed a chronic form, nor induced either stiffness of joints, or other appreciable injury. At the time I saw him he was suffering from obstinate diarrhœa, which caused fatal exhaustion. Permission was given to examine one great toe, and the metatarso-phalangeal joint was found much diseased, spots of chalky matter being seen on the external surface of the ligaments and in the groove of the peroneus longus muscle; when the joint was opened, the rounded head of the metatarsal bone, and the cup-like extremity of the phalanx, were discovered to be much incrusted, as also the sessamoid bones. The surface of the metatarsal bone, articulating with the internal cuneiform, was healthy, as also the pulley-like ends of the first phalanx. The synovial fluid was somewhat thick, alkaline in re-action, and the synovial membrane studded with minute white specks of urate of soda.

Case 8.—W. J., a gentleman, aged 49, a surgeon by profession, had no hereditary predisposition to gout, but had evidently acquired the disease by free living. The first fit occurred about thirteen years before his death, and was confined to the ball of one great toe; in the second attack, one of his knees was affected as well as the great toe; he had suffered altogether from eight attacks, but not during the last eighteen months; once only did the disease extend to the upper extremities, and then a single joint of one of the fingers becâme implicated. About six months before his death he began to suffer from symptoms of hepatic disease, and afterwards from ascites, for which he was tapped. His death resulted from the exhaustion of diarrhœa following the operation.

During life he was not troubled with stiffness or deformity, and not the slightest appearance of urate deposit was seen, either upon the ears or elsewhere;

in fact he did not consider himself a very gouty subject. No trace of albumen was present in the urine.

On post mortem examination, the liver was found contracted, the capsule thickened, and the surface of the organ somewhat uneven. On section, the structure was seen to be coarsely granular. There was some hypertrophy of the left ventricle of the heart, and deposits on the aortic semi-lunar valves.

Examination of joints.—In the left great toe the head of the metatarsal bone was found sprinkled with deposits of urate of soda, as was also the cup-shaped end of the first phalanx; white patches were likewise seen on the articulating surfaces of the sessamoid bones, and the ligament had a few spots of the same upon its internal surface. These appearances are depicted in fig. 13.

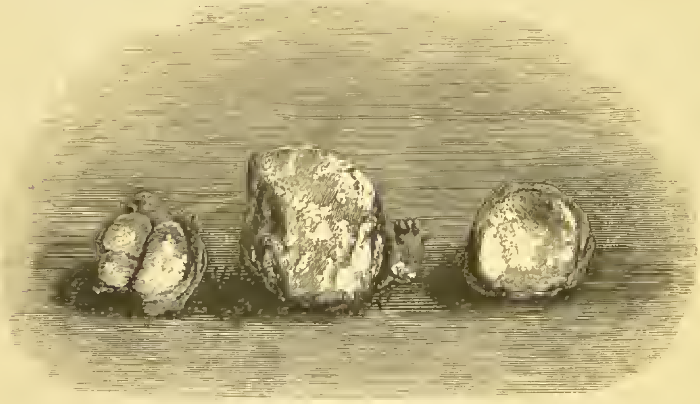


Fig. 13.*

The ball of the right great toe was similarly affected, and in about the same degree. The synovial fluid in both joints was distinctly alkaline in re-action and normal in appearance.

---

* Fig. 13 represents the appearance of the articulating surfaces of the bones of the ball of the left great toe of W. J., in whom only eight

The heads of the femur and tibia and the articulating surface of the patella in both knees were pretty freely sprinkled with white patches of urate of soda, and points of the same could be seen upon the synovial membrane throughout the joints.

The kidneys exhibited the peculiar phenomena so commonly seen in this disease, although, I believe, never before ascertained to be present in subjects who had only suffered from a few attacks of acute gout.

4. *Examination of a subject in which only the ball of the right great toe had been affected with gouty inflammation.*

Case 9.—R. R., a male aged 50, who had during the last ten years suffered much from palpitation of the heart and difficulty of breathing, symptoms depending on the presence of hypertrophy and valvular disease of that organ; he had also been much troubled with cough.

R. R. could not discover any hereditary predisposition to gout in any part of his family, but had always lived well, and drank pretty freely of malt liquors. Three years and a half before his death he had a

---

attacks of gout had ever occurred; no trace of deposits was seen externally, and no appreciable stiffness of the joints or deformity existed.

distinct fit of gout in the ball of the right great toe, of moderate severity; and a year afterwards a second fit occurred in exactly the same situation. In neither attack were other joints implicated. From the time of the second attack until his death he had not the slightest return of gout. No albumen was present in the urine. A post-mortem examination revealed considerable cardiac disease, the heart weighing twenty-six ounces avoirdupois. The walls of the left ventricle were much thickened, and the aortic valves covered with excrescences, and altogether inefficient; the kidneys, weighed six and seven ounces respectively, were apparently healthy, with the exception of a large cyst in the right. The metatarso-phalangeal articulation or ball of the right great toe, the only joint ever inflamed, exhibited the following appearances when opened:—A moderate amount of synovial fluid was present, healthy in appearance, and distinctly alkaline in re-action. A large white patch was seen on the head of the metatarsal bone, occupying about one-tenth of the whole surface, and when carefully examined found to consist of many minute patches aggregated together; on the surface of the cup-like end of the phalangeal bone more of this white matter was observed, occupying perhaps as much as one-fourth of the cavity; the deposit was by no means dense, and did not appear to cause any elevation of the surface. The articulating surfaces of the sessamoid bones were free. These appearances are represented in fig. 14 (1).

Besides these deposits, it will be observed that there was a very distinct sprinkling of the same substance upon the inner surface of the ligaments.

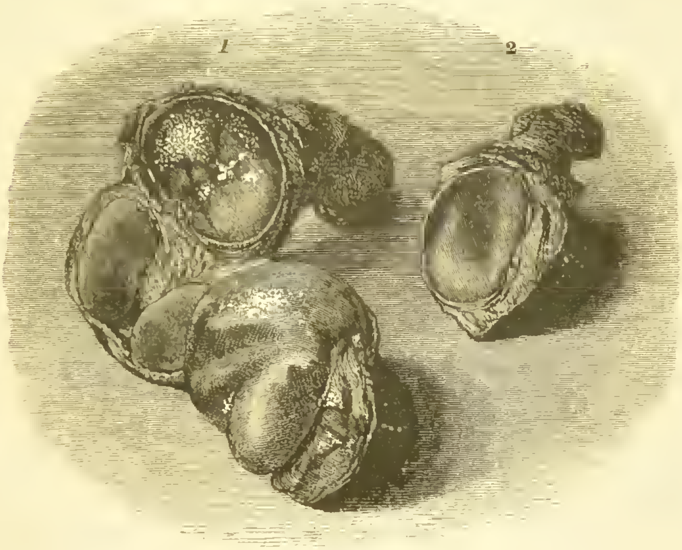


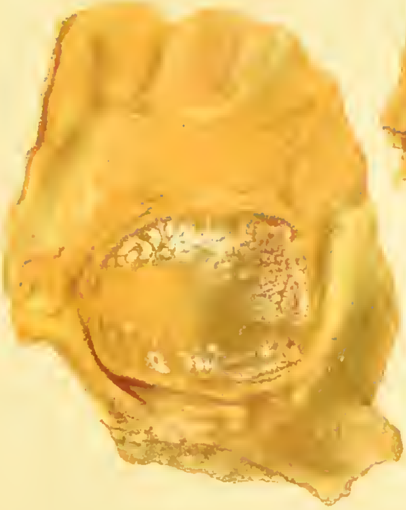
Fig. 14.*

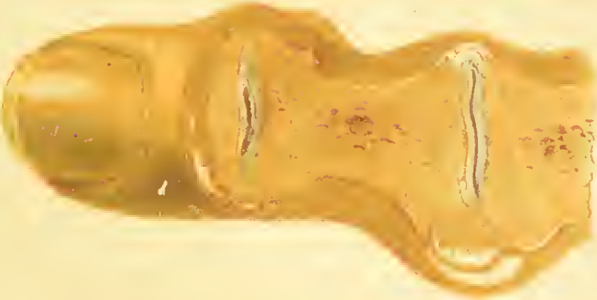
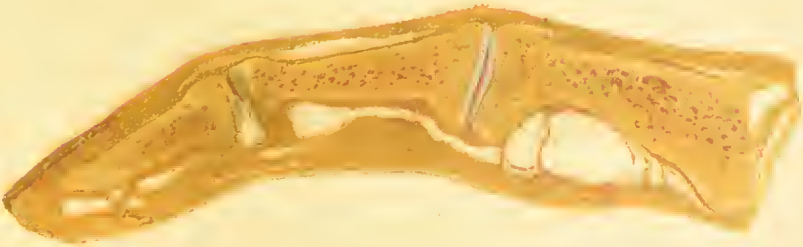
The corresponding joint of the left great toe was healthy, and all the phalangeal joints of both feet. In fact, no other part examined exhibited the slightest trace of disease. Fig. 14 (2), exhibits the appearance of the cup end of the first phalanx of the healthy toe. The deposit shown in the drawing was examined both microscopically and chemically, and found to be identical both in form and composition with that constantly found in this disease, and which will be fully described in the next chapter.

---

* Fig. 14 (1). Drawn from the ball of the right great toe of R. R., a patient who only experienced two slight attacks of gout, both confined to the joint in question.

Fig. 14 (2) represents the appearance of the end of phalangeal bone of the corresponding joint of the left great toe, in which no trace of urate of soda existed.



CHAPTER VII.

MORBID ANATOMY OF GOUT CONTINUED:—DEDUCTIONS DRAWN FROM THE CASES RELATED IN THE LAST CHAPTER—PROOFS OF THE INVARIABLE DEPOSITION OF CHALKY MATTER IN THE INFLAMMATION OF TRUE GOUT—MICROSCOPIC AND CHEMICAL CHARACTERS OF GOUTY DEPOSITS IN DIFFERENT STRUCTURES—IN ARTICULAR CARTILAGE—SYNOVIAL MEMBRANE—FIBROUS TISSUE—CHANGES IN THE KIDNEYS OF GOUTY SUBJECTS: 1. IN THE CHRONIC FORMS OF THE MALADY; 2. IN THE EARLY STAGES—DEPOSITS IN OTHER SITUATIONS—OFTEN UNCONNECTED WITH THE DISEASE.

FROM an investigation of the phenomena brought to light in the last chapter, more especially with regard to cases of gout in which no appreciable deformity or rigidity of joints had existed during life, some very important deductions may be drawn; deductions which cannot fail to exercise a strong influence upon our view of the intimate nature of the disease, and which we shall now endeavour to explain.

In the examination of our first class of cases—namely, subjects of chronic gout, with extensive chalk-stones—the results obtained, as far as the appearances to the unassisted eye are concerned, are almost the same as those of other observers, and have been already sufficiently explained; such, for instance, is the more or less complete incrustation of the surfaces of the bones with the white matter, the infiltration of the surrounding ligaments, and the deposit within the tendons and their sheaths, and occasionally along the tendinous expansions of the muscles; this latter I have noticed, in two or three instances, during life, especially at the back of the thigh. After a time, when the secretion of urate of soda into the tissues increases, neighbouring parts are pressed upon, atrophied, and absorbed, and hence the deposited matter slowly approaches the surface, usually in a semi-fluid form at first, but gradually becomes solid and chalk-like from the absorption of the more fluid portion of the morbid effusion. When there is only an integument covering the cartilage, as in the case of the helix of the ear, the deposit makes its appearance at the surface soon after its secretion; but when many other structures are interposed, a considerable time usually elapses before this occurs, and the deposit may have undergone considerable hardening from the absorption of its more fluid portion. The only point in which my observations seem to differ from those of Cruveilhier and M. Fauconneau Dufresne is with regard to the occurrence of the white deposit within the substance of the bones and altogether disconnected with the cartilage. The French observers found it in the astragalus, os calcis, and patella. I have sought for it in these situations in many cases, but have not seen it, except in direct connection with the cartilage, although in some of the phalanges it had penetrated to a considerable depth, when the osseous tissue had become much pressed upon and atrophied.

In the second class of cases, where no appreciable deformity was present, and no chalk-stones except one or two specks on the cartilage of the ear, the examinations brought to light the fact, I believe before unknown, that extensive deposits may take place internally without corresponding external development; as many of the joints of these subjects were greatly affected, on their articular cartilages, and also the synovial membranes and ligamentous structures. It was also rendered probable that a close relation exists between the presence of the deposit and the occurrence of true gouty inflammation; for in Case 4 the joints less commonly implicated in this disease were discovered to be free from deposit; such was the case with both hip and shoulder-joints, and one elbow; whereas the joints frequently affected with gout were found incrusted after death. As the history of this latter case was unknown, there were no means of positively ascertaining which joints had been inflamed during life.

In the third class of cases, where no trace of external deposit was present, it was clearly demonstrated that the joints may become seriously incrusted without yielding any evidence to superficial examination.

In Case 7 one great toe only was examined, here the interesting fact was elicited, that the articular cartilages of the ball or metatarso-phalangeal joint may be completely incrusted with white deposit, the surrounding ligamentous tissues freely sprinkled with the same, and still the articulating surface of the metatarsal bone with the tarsus, and likewise the phalangeal joint, remain free from all disease: this I have seen in other instances, and it exemplifies the great tendency of gout to select one joint in preference to others.

In Case 6 many joints of the lower extremities were affected, but with complete freedom of the upper limbs and hip-joints; thus pointing to the same conclusions as Case 4, but in a still more marked degree. In investigating the history of gout it is usual to find that many years elapse before the disease creeps beyond the knees, sometimes this never occurs, although the patient may continue to suffer for a lengthened period.

By Case 8 we are enabled to confirm in a remarkable manner the conclusions to which the foregoing cases point. The history was well known; the patient had been a medical man, and could give the details with accuracy, and it was positively ascertained that only eight fits of gout had ever been present, and these had been spread over a period of thirteen years; once only was a finger affected, the remaining attacks being confined to the great toes, feet, and knees. In this case the examination showed an incrustation of all the joints known to have been implicated, and the freedom of other joints, and thus almost proved to demonstration that gouty inflammation is invariably accompanied with deposition of urate of soda.

It was, however, in Case 9 that this fact was proved beyond all possibility of doubt, for the patient had only experienced the disease in a single joint, namely the ball of one great toe, and even in this the disease had not been severe; still the surfaces of the metatarsal bone and phalanx were sprinkled over in a marked degree, and a spot was likewise observed on the ligament; the articulating surfaces of the sessamoid bones were quite free.

Mr. Spencer Wells once examined the foot of a gentleman who died suddenly from apoplexy during a fit of gout. He had previously suffered from three or four similar attacks in that locality. The fascia around the digito-metatarsal joint of the great toe was found to be thicker, tougher, and more leather-like than natural, the synovial membrane of the joint being intensely red and quite dry. There was also considerable edema of the whole foot. It does not appear that the cartilage was examined in this case, or the presence of a deposit of urate of soda sought for.

Other observers have found an appearance of redness, thickening, and dryness of the synovial membrane, with fluid effused into the affected cavities.

The establishment of the fact that gouty inflammation is invariably accompanied with the deposition of a peculiar salt is of the highest importance, inasmuch as it proves the inflammation to have a specific character, and to differ entirely from the various other morbid affections of the joints with which it has hitherto been confounded.

I may add here that although I have made many examinations of the joints of the subjects of different articular diseases, in no other affection have I ever detected this deposition on the cartilages or elsewhere. It never occurs in acute or chronic forms of rheumatism, nor in the disease commonly known by the name of chronic rheumatic arthritis, although alterations of a still more serious nature are frequently met with in these latter cases.

I am also of opinion that not only is the deposition of urate of soda constantly found in gouty inflammation, but that it stands in relation to it as the cause rather than effect; or the deposition of the salt first takes place in the synovial membranes, cartilages, and tendinous structures of the joints, and by its presence gives rise to inflammatory action. Many arguments might be adduced in support of this statement, which we shall have an opportunity of more freely discussing in a future chapter. I may, however, allude here to two circumstances strongly favouring the above view; namely, that when deposition occurs in parts of low vitality, as in the fibro-cartilages of the ears, there is comparatively little subsequent inflammation, although often sufficient to call forth the attention of the patient; and again, when inflammation runs high, destruction of the urate to some extent is the consequence, as proved by the absence of uric acid in the blister-serum of an inflamed part.

Microscopic and Chemical Characters of Gouty

Deposits in different Structures.—We have spoken of the white plaster-like matter as occurring upon the cartilages, in the tendons, and other parts, without any particular reference either to its minute characters or chemical composition; to these points it is incumbent upon us now to direct our attention. In the description given of the morbid appearances, we have seen that the chalky matter has been sometimes stated to replace the cartilages supposed to have become absorbed, sometimes to have been spread over their surfaces in the form of a thin layer, the cartilage remaining intact: but on minute examination both these statements are found to be erroneous; for, in the first place, the cartilage can be again restored to an almost normal condition, and secondly, rubbing or scratching the surface will not remove the deposit, unless sufficient force be employed to injure the cartilage itself; in fact, as we proceed in our inquiries we shall find that the white deposit is altogether interstitial in character.

In a communication on Gout published in the Transactions of the Royal Medical and Chirurgical Society, 1848, I gave a drawing of articular cartilage taken from the metatarsal bone of a gouty patient, whose foot had been amputated by the late Mr. Liston, and it was there shown that the white deposit was entirely crystalline, consisting of minute needles of urate of soda, arranged in the manner exhibited in Plate 5, fig. 2.

Subsequently I exhibited a specimen at a meeting of the Pathological Society, proving that the deposit was not on the free surface of the cartilage, but that external to it a thin organic layer could often be demonstrated. Since this period Dr. W. Budd has particularly examined the structure of such cartilage, and the results of his investigations are published in the Medical and Chirurgical Transactions for 1855.

If we make a thin vertical section of a piece of cartilage containing this deposit, that is, a section cut from the free surface in the direction of the bone, we at once discover that the matter ordinarily extends to a comparatively small depth in the substance of the cartilage, seldom penetrating beyond two-thirds of the thickness, often much less; and it will also be seen that this deposit presents a beautifully crystalline appearance, as seen in Plate 5, fig. 1. The phenomenon can be well observed when we examine the specimen with a linear magnifying power of from 100 to 200, either by transmitted or reflected light, and still more satisfactorily by the aid of polarised light. Dr. Budd, in the paper above alluded to, states that the foreign matter takes two distinct forms, in some situations being granular or amorphous, in others perfectly crystalline. I have made some hundred sections of such cartilage taken from many different gouty subjects, and from various joints, and although the matter has at first occasionally presented the granular form, yet further examination, more especially by the aid of the polariscope, has always shown it to consist of minute crystals, the apparent amorphous appearance having been due to the direction of the needles, and not from any want of crystallisation. In the drawing, Plate 5, fig. 1, the thin membranous layer external to the deposit will be observed, a phenomenon which has also been described by Dr. Budd in the communication before alluded to; Mr. Toynbee, in a paper on articular cartilage, in the London Journal of Medicine, 1850, considered that this discovery of the thin organic layer, argued strongly for the existence of a synovial membrane over the articulating surfaces. In Plate 5, fig. 2, a horizontal section of the cartilage is shown; the crystals, however, are seldom met with so symmetrically arranged. The above drawing was made in 1848, from the specimen given to me by Mr. Liston. The density of the deposit is always found to be greatest at the surface, gradually becoming less as it penetrates into the structure. In bones which are only moderately sprinkled with the white matter, the penetration does not often exceed one-third of the whole thickness, or at least the crystals become

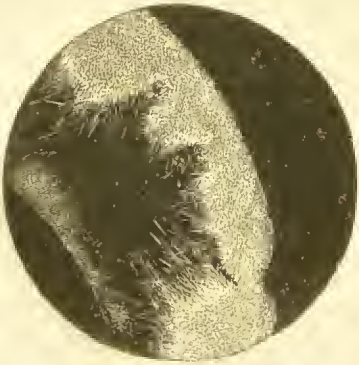


Fig. 15.*

---

* Fig. 15. The appearance presented by a very thin vertical section of gouty cartilage: the matter is seen to be most dense at the free surface, and gradually to become thinner as it penetrates into the structure. From a specimen preserved in Canada balsam. Linear magnifying power 220. Polarised light.

so few and fine that they are not visible beyond this depth unless great precautions are adopted; but sometimes upon the end of bones which have long been the seat of the disease, the entire thickness of the cartilage seems to be implicated. The appearance presented by a thin vertical section when seen under polarised light, is represented in Fig. 15, the fine prismatic needles are observed to penetrate to some considerable depth: near the surface the light appears intense from the interlacement of innumerable crystals. When properly exhibited as an opaque object it is also very beautiful.

In order to determine the intimate nature of the deposit within the cartilage, we have only to take thin slices of it, wash them with cold water and afterwards with alcohol, for the purpose of removing any matter readily soluble in such menstrua; then digest in warm water, under 200° Fahr., until the cartilage has become transparent; the watery solution after evaporation and cooling, will deposit beautiful tufts of crystals (Fig. 16), which can be readily demonstrated to consist of pure urate of soda, for when

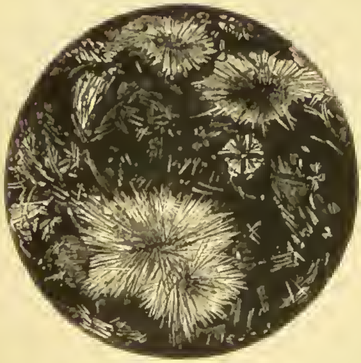


Fig. 16.*

---

* Fig. 16 represents the crystallisation of urate of soda from the watery solution in which gouty cartilage had been digested, seen under polarised light. Linear magnifying power 220.

incinerated a soluble alkaline ash is left, consisting of carbonate of soda; and the crystals themselves dissolved in water, and treated with acetic acid, give rise to uric acid in its characteristic rhombic forms. (Plate 6, fig. 1.) If the crystals be treated with dilute nitric acid on a piece of white porcelain, and, when almost dry, held over a solution of ammonia, they give rise to a brilliant purple appearance from the production of murexide. By these reactions, as well as from the forms in which the salt crystalises, it can be demonstrated, that the matter giving the white opacity to the cartilage consists solely of urate of soda.

When the extremity of a bone completely and thickly covered with urate of soda, is digested in warm water for some days, the whole of the deposit is removed, and the end of the bone then presents an almost healthy appearance, being left completely covered with cartilage. In some of my experiments I should have been unable to determine whether or no it had been previously diseased; in fact, the only difference which I have observed, has been a somewhat uneven surface and a transparent and spongy appearance of the cartilage on drying; the latter apparently arising from air entering into the interstices previously occupied by the deposit of urate of soda. To ascertain this point without risk of error, I have taken the end of two bones from the same individual, and subjected them to similar influences, either to water at the temperature of

100 Fahr., or to the action of a weak solution of the carbonate of some alkali. Fig. 17 shows the appearance of two metacarpal bones, one incrusted with the deposit, the other freed from it by the long continued action of warm water; the latter was if anything, more thickly covered than the former before the commencement of the experiment. These observations prove beyond doubt, that the supposed absorption of the cartilage, and the after superposition of a layer of foreign matter, is erroneous, and that the deposition is entirely interstitial in its nature. If thin layers of

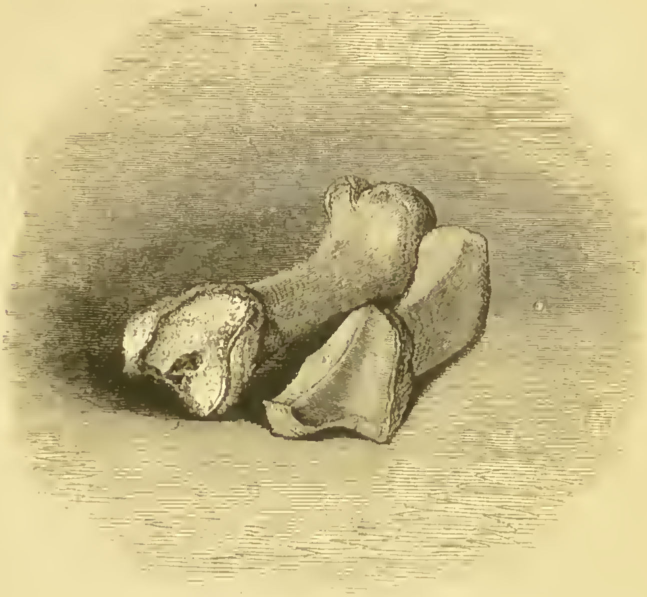


Fig. 17.*

---

* Fig. 17 represents the ends of two metacarpal bones, one incrusted with urate of soda, the other freed from the deposit by the action of warm water, and exhibiting the cartilage apparently healthy in structure.

gouty cartilage are submitted to the action of warm water for some hours, the deposited matter will be gradually dissolved until at length it is quite removed, after which the cartilage will be found to have apparently recovered its healthy structure. By such a mode of proceeding, watching the specimens in the different stages, much light will be thrown upon the mode in which the deposition has originally taken place. In some specimens I have noticed, that after much of the urate of soda has been removed by the water, rhombic crystals of uric acid have been left within the cartilage: it is however probable, that the reduction of the acid is only a post-mortem effect from the generation of another acid by decomposition. In almost every case I have observed, that as the solution of the urate of soda proceeds, the deposit assumes the appearance of being composed of small masses of crystals separated from each other by clear interspaces, and after the further action of the water, it has been shown that such masses have occupied the situation of the nucleus cells of the tissue. These latter are observed in Plate 5, fig. 1.

In detailing the post-mortem examinations of the joints of gouty subjects, we stated that the synovial fluid was occasionally of a thick consistence, and more or less opaque, sometimes studded with little white points; when examined by the microscope, it is found to be also crystalline, exhibiting fine needles or prisms, usually aggregated together in the form of bundles. The crystals are soluble in warm water, the solutions yielding the characteristic murexide test, and on the addition of an acid, depositing rhombic crystals of uric acid: in short, the opaque matter within the synovial fluid is thus proved to consist of urate of soda, the same salt that exists within the cartilaginous structure, and probably, at least in the less advanced cases, crystallisation has not taken place until after death, and then only from the decrease of temperature. In some of the more chronic forms of gout, this may have occurred during life, and would account for the masses of white matter which have been found in the knee-joint by Dr. Bence Jones. From experience however, I can assert, that such does not commonly happen, and that even in joints very considerably affected, the cavities remain free from deposit, although white points may be visible in the synovial fluid.

In speaking of the dissections of the larger articulations, and more especially the knee-joint, very minute white points have been noticed as occurring upon the synovial membrane; if a portion of this tissue be removed, and placed under the microscope with a low magnifying power, about 60 linear, with the use of polarised light, an appearance represented in Fig. 18 (1) is observed, showing the studding of the membrane, with small white masses arranged at small and somewhat equal distances from each other. When a very minute mass is selected and subjected to a higher power, about 220 linear, the crystalline structure becomes apparent, especially if a little pressure be used upon the thin upper glass covering the membrane, by which means the globular mass becomes flattened and the needles of urate of soda rendered more evident; this is represented in Fig. 18 (2). When the membrane is submitted to the long continued action of warm water, the masses are gradually dissolved, and the tissue left in an apparently normal state.

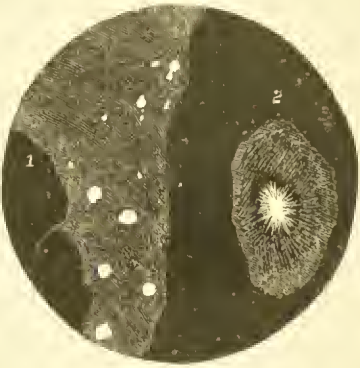


Fig. 18.*

Ligamentous and fibro-cartilaginous tissues, tendons and their sheaths, when incrusted with urate of soda, present under the microscope appearances very similar to those of articular cartilage; although it frequently happens, that the crystalline structure in the latter, is not so regular as in the former, or in the synovial membrane. I may here remark in conclusion, that in whatever tissue or situation, urate of soda is deposited, it invariably exhibits a crystalline appearance, although sometimes the prisms are exceedingly small, requiring high magnifying powers and the use of polarised light to define them very clearly.

---

* Fig 18. A drawing from a small piece of synovial membrane from the knee-joint, under polarised light. (1) Shows the appearance with a magnifying power of 60 linear. (2) One of the smaller points with a magnifying power of 220 linear, exhibiting the crystalline structure.

Changes in the Kidneys of Gouty Subjects.—It has long been a prevalent idea that some connexion exists between gout and an altered secretion from the kidneys, an opinion probably derived from the supposed frequency of the occurrence of gout and gravel in the same individual, strengthened by the fact that the most common constituent of urinary gravel and calculus is identical with the acid existing in the chalky deposits of gout. It is true that gout and gravel frequently happen to the same patient, occasionally simultaneously, but more commonly at very different periods of life, or those who in middle life and old age suffer from the former, in youth were subject to the latter.

Some years since Dr. Todd drew the attention of the profession to a condition of the kidney which frequently occurs in cases of inveterate chronic gout, and named by him the gouty kidney, but I believe there is nothing published throwing any light on the changes in these organs in patients who have only suffered from the acute variety of the malady. Within the last few months I have been enabled to speak more positively upon this subject, to clear up much that formerly appeared obscure, and to show that even in the slighter forms and early stages of gout, the renal organs become seriously implicated.

The so-called gouty kidney, such as occurs in advanced disease, and in chronic desquamative nephritis, has the following characters. It is usually considerably contracted, often not more than one-half or one-third the natural size, with a shrivelled appearance, the capsules thickened and opaque, and the surface granular. On section it is found that this decrease in size is chiefly at the expense of the cortical portion, which is sometimes so extremely wasted, that the pyramids almost reach the surface of the organ.

In 1849, when examining the kidney of a gouty man who had died from some other disease, I observed that not only had it the characters above described, but that there existed considerable deposition of a chalk-like substance, which was seen in the form of streaks; these white lines were chiefly in the direction of the tubes of the pyramidal portion, some, however, were found in the cortical part; the mamilla of each cone also presented the appearance of little white points, from the deposition of the same matter in this situation. Dr. Todd in his lecture on urinary diseases, also mentions this fact, and gives an account of the post-mortem examination of a gouty patient who died from cholera, where this phenomenon was observed by Mr. Ceeley.

The external appearance presented by the kidney in this form of gout is exhibited in Plate 4, fig. 2 *a*, and the section of such a kidney is seen in the same figure, *b*, where the white points and lines are distinctly shown, as well as the contracted state of the organ. These drawings, it will be remembered, have been previously referred to when describing the post-mortem examination of my first case, from which they were delineated.

When the white matter is placed under the microscope, it is found to be crystalline in structure, and consisting of urate of soda in the form of prisms. A representation of the end of one of the pyramids, showing the form of crystallisation of the deposited matter, is given in the accompanying woodcut. (Fig. 19.)

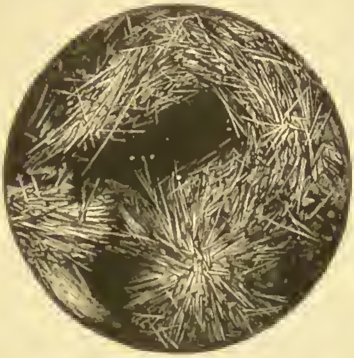


Fig. 19.*

I have examined the white deposit from numerous kidneys taken from other gouty subjects, and the microscopic appearance has always closely resembled that represented above. When the crystals are chemically tested, they are at once shown to consist of urate of soda, and to be identical with the matter which forms the essential part of chalk-stones, and produces the alteration in articular cartilages; for they are soluble to some extent in hot water, yield the murexide test when heated with nitric acid and ammonia, and afford crystalline rhombs of uric acid when treated with a stronger acid.

---

* Fig. 19 represents the crystals of urate of soda in the pyramidal portion of a gouty kidney. Linear magnifying power 220, and polarised light.

The phenomenon just alluded to, as well as the contracted state of the organ, I have now frequently observed—in fact in all cases of chronic chalk-gout where the opportunity of making an examination has been afforded; and the kidneys have seldom been found to weigh more than 3¼, sometimes as little as 2½ ounces.*

The contracted state of the kidneys in gout had been noticed long since, though no stress was laid upon the point until within the last few years. Mr. Henry Watson, in 1782, when describing the autopsy of the patient before referred to, who was able, at cards, to score up the game with his gouty knuckles, speaks of the kidneys as small, and filled with hydatids, (? cysts,) and the outer surface of the right covered with little bladders; but in most of the early accounts of the post-mortem examinations of gouty subjects the condition of these organs is not mentioned.

Is not the same state of kidney found in other diseases besides gout? As far as the contracted or atrophied state of the organ is concerned, the question must be answered in the affirmative; for this alteration is one which not unfrequently occurs in certain forms of albuminuria, and a somewhat similar condition of urine is found in many cases of granular disease, or chronic desquamative nephritis, as in the severe forms of chalky gout. This latter remark holds good, both as regards the ordinary physical qualities, as the low specific gravity, pale colour, and presence of albumen, and likewise the occurrence of the granular and waxy casts of the uriniferous tubes. But I know of no published observations showing the presence of the white streaks of urate of soda in any other disease than gout. I have never met with such myself in cases where I could positively assert no such malady had been present, although in one instance I found them in a man suffering from albuminuria and chronic vomiting; the patient, in fact, in whose blood I first discovered the presence of oxalate of lime.* Not having seen this patient until within a few days of his death, and before the time that my attention had been specially directed to the subject, I cannot say whether or not he had been subject to gout, although the prior occurrence of this disease is rendered somewhat probable from the fact, that a considerable amount of uric acid was found in the blood.

---

* The weight of the healthy kidney has been differently estimated by observers. Some have considered that in the male the average is about five and a half ounces, and in the female five ounces. Others think that four and a half ounces is nearer the healthy average. The left kidney is generally somewhat heavier than the right.

Having noticed the constant occurrence of a morbid state of kidney in advanced gout, and added, if such were necessary, additional proof to the correctness of the observations of Dr. Todd and others, it became a matter of much interest to proceed further with the enquiry, having been for a very long time impressed with the conviction that altered renal secretion was closely related to the disease in question, and endeavour to ascertain whether in its slighter forms, such as in the cases included in the second class of the last chapter, the kidneys were also implicated.

---

* Medico-Chirurgical Transactions, vol. 32, 1849.

In the account of Case 4, it will be observed that there existed, in a well marked form, the shrivelled condition of these organs, and a deposit of crystallised urate of soda in the direction of the tubules; points of the same were also seen at the apices of the cones. The microscopic structure was likewise altered in the manner shortly to be described. In this subject the only external evidence of gout was the presence of two or three small points upon the cartilages of one ear.

In Case 5 the kidneys were also considerably diseased, of small weight, much shrivelled in the cortical portion, and exhibiting the white points at the apices of the pyramids, and streaks of the same salt in the direction of the tubuli. Microscopically the structure was seen to have become much altered.

In Case 7, the renal organs were not examined; the allowed inspection being confined to one great toe.

The kidneys in Case 6 had undergone considerable change, did not exceed three ounces in weight, and contained much urate of soda about the ends of the pyramids, and in the direction of the tubes, which exhibited the usual microscopic appearance.

In Case 8, the alteration in the kidneys was a subject of much interest, as only eight attacks of gout had occurred, and no visible sequelæ had been left by them. Here it will be observed the kidneys were apparently healthy, each weighed four ounces and a half, and the capsules peeled off without difficulty; but when closely inspected, white points were found upon the free ends of the pyramids, and streaks existed, as in the former cases. The microscope also revealed the commencement of other mischief; a portion sent to Dr. G. Johnson, who was unacquainted with the case, elicited the following remarks:—"The epithelium in some of the tubes is very granular, and there are a few denuded tubes; the chief change in the kidney is an excess of oil in the epithelium; the outline of the tubes is very dark, depending on an accumulation of small oil globules in the epithelial lining." The deposited urate of soda was, however, very highly characteristic.

The only gouty subject I have examined in which the kidneys were not distinctly affected, was the patient Case 9, who had only had two attacks of the disease, and both of these confined to the ball of one great toe.

The kidneys were large and congested (the patient died suddenly from cardiac disease), but no evidence of urate of soda could be detected either at the extremities of the cones or along the wall of the pyramids.

When I first observed the white points and streaks upon the pyramidal portion of the kidney, I was inclined to consider the appearance due to the filling of the tubuli uriniferi, and this was evidently Mr. Ceeley's idea; subsequent examinations, however, have led me to form a different opinion; the crystals of urate of soda, which are commonly much larger than in cartilage or ligament, often seem to be imbedded in the fibrous structure itself, rather than within the cavities of the tubules. Further investigations on this point are still a desideratum.

The microscopic appearances of the kidney in this form of disease have been carefully examined by Dr. George Johnson, and fully described in his work on the subject. To this gentleman I am indebted for the loan of the slides from which the drawings exhibiting the morbid appearances of the kidney were made. The change in the early state of the disease, when the kidneys are still of their natural size and weight, and present to the eye nothing abnormal, appears to consist in an altered condition of the epithelial cells of the convoluted tubes, which become opaque and have an unusually fine granular appearance. Dr. Johnson states, that "in some tubes there is an appearance of entire cells having been shed, so as to fill the tubes and render them opaque; while in others there is an equal filling and opacity of the tubes, from containing epithelium in a disintegrated condition, and which has become so either from the crumbling of the cells while they are still attached to the basement membrane, or from the disintegration of the epithelial cells which have accumulated in the tubes after being shed in an entire form by a process of desquamation." There is often besides this an excess of oil in the epithelium.

After a time the matter contained in the tubes becomes disintegrated, and gradually removed by the watery secretion from the Malpighian tufts, and when this is effected the basement membrane is seen to be left almost denuded, and from being partly concealed by the surrounding fibrous rings, gives to the section a somewhat vesicular appearance. The conditions just described are shown in Fig. 20, where the tubes which are filled with the disintegrated epithelial cells are seen to the right and below; whereas the denuded tubes giving rise to the cystic appearance occupy the rest of the drawing. After a time, and as a result of the removal of the epithelium, the tubes gradually become wasted and shrivelled from the collapse of the surrounding tissue; by this change the Malpighian bodies approach each other, and hence appear more numerous than usual in the field of the microscope. This change I have observed in all the cases of advanced gout in which

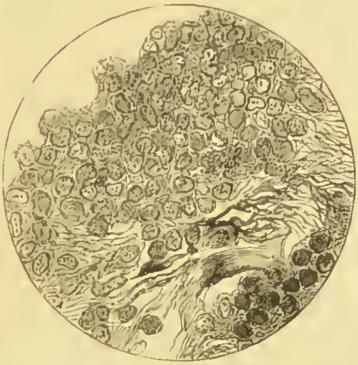


Fig. 20. *

---

* Fig. 20 represents the condition of the kidney in gout and some forms of albuminuria (chronic desquamative nephritis). To the right and below the tubes are filled with disintegrated epithelial cells; the cystic appearance in the other parts is produced by the denuding of the tubes and removal of the epithelium. Linear magnifying power, 100.

I have had an opportunity of examining the kidneys, and it is represented in Fig. 21, where the atrophied and shrivelled tubes may be observed to the right, and the Malpighian corpuscles to the left of the drawing.

During the time the above changes are taking place in the urinary tubes, the blood-vessels of the kidney are undergoing a marked alteration, and this is more especially seen in the Malpighian arteries and capillaries, the coats of which are much thickened or hypertrophied. Dr. Johnson says, that both the circular and longitudinal fibres become affected, but that the longitudinal are increased more than the other set, and hence, when diseased, become of about equal thickness. The smallest arteries or the afferent vessels of the Malpighian tufts are most implicated, and under the microscope exhibit the appearance in Fig. 22, where tortuosity is often combined with hypertrophy. Such a condition of the arteries is only seen when the substance of the organ is much altered, and the impediment to the circulation greatly increased.

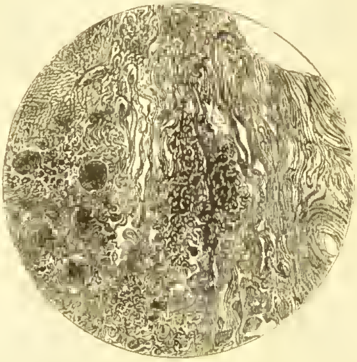


Fig. 21.*

---

* Fig. 21, from a section of a kidney in advanced gout, exhibiting, to the right, the tubes in an atrophied and shrivelled state, and to the left the clustering together of Malpighian bodies. Linear magnifying power, 100.

Little has been made out with regard to the state of the capillaries of the kidney, but they probably become wasted. The walls of the efferent vessels or veins are certainly not hypertrophied, but, like the capillaries, undergo a slow process of atrophy and contraction.

Deposition of Gouty matter in other Organs.—Gouty concretions or deposits have been said to occur not only in the structures we have already alluded to, but also in various other tissues and organs. Thus Rœring found concretions in the lungs of an old man who had suffered from the disease in question, but there is no reason to suppose that they were gouty in character, as they consisted of phosphate of lime, masses of which we know to be far from uncommon in such situations in patients who have never had gout. Landerer found a white deposit on the inner surface of the aorta of a gouty subject, but I am not aware that any chemical analysis of it was made.

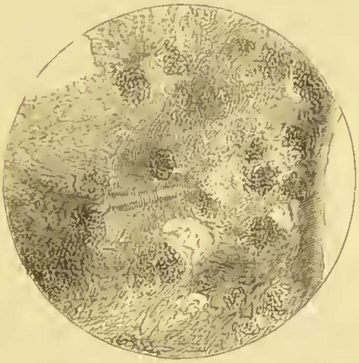


Fig. 22.*

I have carefully examined the deposits found on the valves of the heart and the atheroma from the aorta of several gouty patients having extensive chalk-stones, but have always failed to discover the least trace of uric acid; but tabular crystals of cholesterine are often present in such matter.

---

* Fig. 22 represents the hypertrophy of the Malpighian arteries ; the muscular fibres are seen to be much enlarged, more especially the circular, in the drawing. Some alteration of focus is required to bring the longitudinal set into view. Linear magnifying power, 100.

Deposits are also stated to have been found in the meninges of the brain of gouty subjects, and Schonlein is said to have detected urates in them; there is no doubt but that they generally consist of phosphate and carbonate of lime, and probably have no relation whatever to the disease under consideration. It may be remembered that Mr. H. Watson, in his description of the appearances presented by the gouty individual before spoken of, mentions that on the outer surface of the pia mater there was a cream or smooth chalk-like mucus. At the time he published his examination, nothing was known of the chemical nature of gouty deposits, their physical characters only were regarded. In many other observations, the error has frequently been committed of looking upon all the morbid alterations found in the subject as necessarily connected with gout, whereas they may not be in the most remote degree allied to this disease.

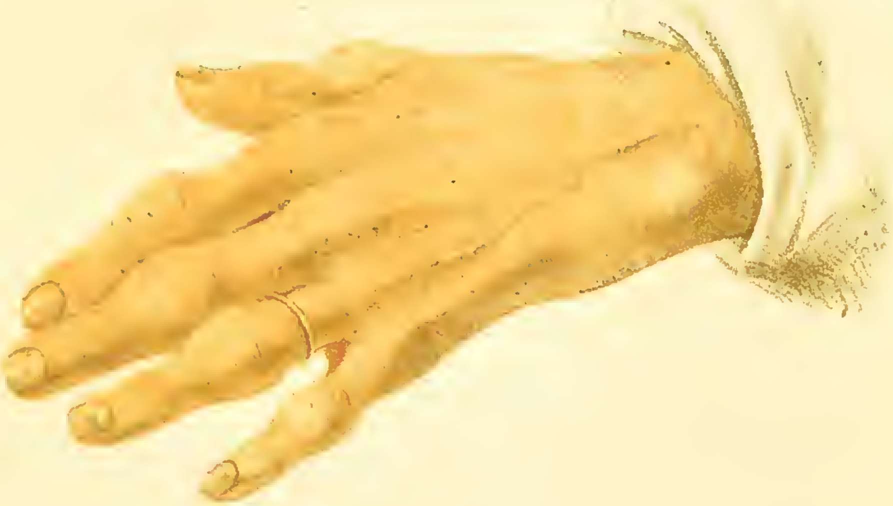
During the time the chapters on the morbid anatomy of gout were passing through the press, I had an opportunity of making an autopsy of a man fifty-seven years of age, who died from the effects of a very severe accident. He had previously had about twelve attacks of gout; the early fits were chiefly confined to the great toes, but the latter had implicated the knees, and also the wrists and hands.

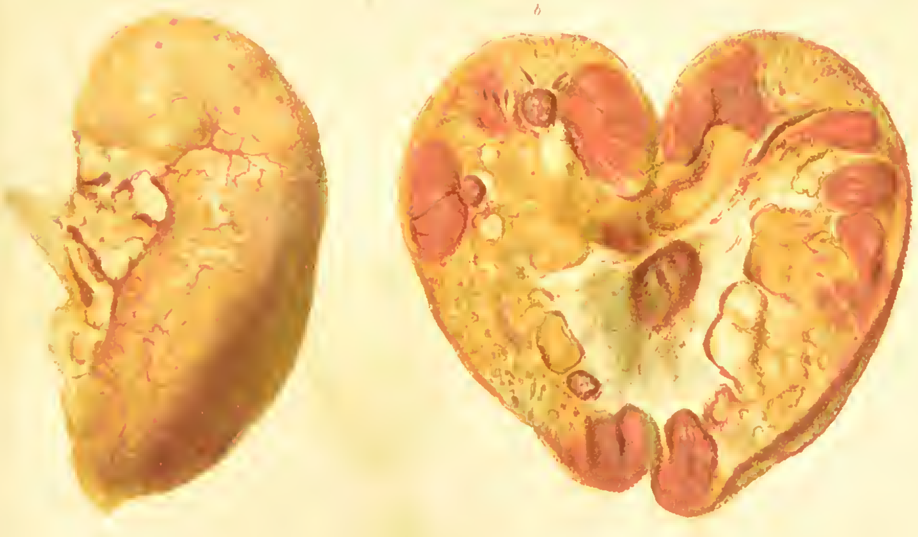
With the exception of a single speck of urate of soda about the size of a large pin's head, situated upon the helix of the right ear, no external deposits were visible, and there was an absence of any marked stiffness or deformity. An examination was made of the right hand, which had been seriously injured by the accident, and amputated during life; also of both great toes and knees, and several other articulations. In the metatarso-phalangeal joint of each great toe, the cartilages were completely infiltrated with urate of soda, even the surfaces of the sessamoid bones and ligaments, exhibiting an appearance resembling Fig. 13, (p. 216), but more strongly marked. Many of the other joints of the feet were similarly but slightly affected, the knees being merely streaked with the white matter to about the same degree as in Fig. 12, (p. 207). Nearly all the surfaces of the carpal and metacarpal bones, as also those of some of the phalangeal joints, were likewise incrusted.

The kidneys were congested and granular, each weighing nearly six ounces avoirdupois, and, on careful examination, white points and streaks of urate of soda were observed at the ends of the pyramids, and in the direction of the tubuli. The urine of this man was strongly albuminous. The deposits in the cartilages, ligaments, synovial membranes, and kidneys were microscopically examined, and exhibited the crystalline appearances illustrated in the present chapter.*

---

* Further observations on the Morbid Anatomy of Gout are contained in the Appendix.





[illegible]

W. [illegible]ome imp

[illegible]

CHAPTER VIII.

CAUSES OF GOUT:—PREDISPOSING CAUSES: HEREDITARY INFLUENCE—SEX—AGE—TEMPERAMENT OR CONSTITUTIONAL PECULIARITY—ALCOHOLIC LIQUORS—DIFFERENCES IN THEIR POWER OF INDUCING GOUT—INDIGESTION—ANIMAL DIET—ABSENCE OF EXERCISE—SEVERE STUDY—MENTAL ANXIETY—CLIMATE—LEAD AS A PREDISPOSING CAUSE OF GOUT—GREAT FREQUENCY OF THE DISEASE AMONG PAINTERS AND PLUMBERS—INFLUENCE OF THE ABSORPTION OF LEAD UPON THE EXCRETION OF URIC ACID.—EXCITING CAUSES: WINES, &C.—DYSPEPSIA—COLD AND MOISTURE—MENTAL AND BODILY EXCITEMENT OR FATIGUE.

THE most casual observer must at once perceive that great differences exist among individuals as far as their liability to gout is concerned: some are born with a well marked predisposition to the disease; others, by the nature of their occupations or habits, acquire it; at some ages it is frequent, at others rarely met with; some causes act slowly, requiring months or even years to develope the affection, other influences, although powerless in inducing the disease, may yet in certain subjects rapidly bring on an attack in those already predisposed. The causes of gout may therefore be conveniently divided into two classes, predisposing and exciting.

1. *Predisposing Causes of Gout.*—Of these, some manifestly depend on constitutional peculiarity or are

inherent in the individual; others are from without, or produced by external influences.

Influence of Hereditary Predisposition on the Occurrence of Gout.—Most writers acknowledge this influence to be very potent in inducing gout, some even have gone the length of considering it purely hereditary; such, for example, was the opinion of Dr. Cullen. That it may sometimes be, nay often is, acquired, we shall bring forward abundant evidence in this Chapter to prove. Sir C. Scudamore gave a table showing how far hereditary influence could be traced in his cases, and in 522 patients, arrived at the results exhibited in the following table :—

Hereditary from the Father	in 181	cases.
,, ,, Mother	in 59	,,
,, ,, Father and Mother . .	in 24	,,
Of those whose Grandfather on each side had gout, the number was	3	,,
Grandfather on one side only	37	,,
Grandmother only had gout	3	,,
Grandfather and Grandmother	1	,,
An Uncle only in family had gout . . .	21	,,
An Aunt only had gout	3	,,
Gout not known either on Father's or Mother's side	191	,,
	522	,,

In this table the influence of hereditary predisposition can apparently be traced in 332 cases out of 522, or in the ratio of 322 to 190; but, taking the number of those in whom the predisposition could not be considered immediate, that is, directly derived from either or both parents, the ratio would be 258 to 264, or rather less than one-half.

In a collection of cases of gout made by a Commission of the French Academy, the influence of hereditary predisposition is also shown, though in a less marked degree than in Sir C. Scudamore's table. Of 80 patients suffering from acute or chronic gout, 34 attributed the disease to this influence, and in 46 it seemed to have been acquired.

Some years ago, in a table I formed of cases of gout occurring in the wards of the hospital, in 50 per cent. the influence of hereditary predisposition was well established, and since that time a similar table has exhibited a like result; when, however, cases of gout occurring in my private practice are included, the numbers are somewhat different, and a still higher per centage obtained.

On the other hand, I am perfectly convinced that gout is frequently acquired in this country, even when it occurs at a somewhat early age, for in many of the most inveterate cases I have ever met with, the patients could not trace their affection, in the most remote degree, to hereditary influence. In one case, a female, only thirty-nine years of age, (the examination of whose urine I have given in another part of this work,) no such predisposition could be discovered, yet the disease was most severe, and after a few years she was completely crippled, from chalky deposits in the hands, feet, and in many of the larger articulations. Heberden relates a similar case, of a female who suffered from gout to such a degree as to have numerous sores from chalk-stones, and yet the disease had never been heard of among any of her relations.

Some physicians, on the other hand, assert that gout is not hereditary, but the above table, as well as all other careful observations, show that the children of gouty parents are, *cæteris paribus*, more liable to the disease than those who have no such descent.

A few years since, I was consulted by a gentleman labouring under a severe form of gout, with the development of chalk-stones, and, although not more than fifty years old, he had suffered from the disease for a long period. On inquiry I ascertained that for upwards of four centuries the eldest son of the family had invariably been afflicted with gout when he came into possession of the family estate.

It would be needless to dilate further on this subject, as all who have had an opportunity of becoming conversant with the history of this malady must be fully convinced that hereditary predisposition plays no unimportant part in its development.

It is a common opinion, and one with which from my own experience I should be inclined to agree, that the disease appears earlier in life when a hereditary predisposition exists, than when simply acquired. Sir C. Scudamore, in the first edition of his work, held the same view, but he afterwards stated that on putting the question to the test by the examination of 214 persons under his own care who had gout in a very severe degree, and omitting all cases of a milder description, he arrived at the conclusion, that although the influence of hereditary predisposition was well marked in causing the appearance of the disease at an earlier period of life, still that it was by no means so strongly shown as previously supposed. Thus, out of the 214 cases above alluded to, 124 were hereditary and 90 acquired ; of the hereditary there were 8 men and 2 women before the age of 20, 50 men and 6 women between the ages of 20 and 30, and 50 men and 8 women between the ages of 30 and 40.

Although I have seen many patients suffering from gout in early life who could not trace hereditary predisposition in any branch of their families, still these cases have been all satisfactorily accounted for by the habits of life, and I do not remember a single instance of its occurrence in youth which could not be thus explained.

Influence of Sex upon the Occurrence of Gout.—That women are less subject to gout than men is beyond doubt a well established fact, but at the same time the aphorism of Hippocrates, "Mulier podagrâ non laborat nisi ipsi menstrua defecerint," although possibly correct at the time and place it was written, certainly does not now hold good. Still, even at the present time, the disease, at least in its regular and developed form, is comparatively rare among females. The reason of this immunity from gout enjoyed by the female sex, will not be difficult to understand after we have discussed the predisposing and exciting causes which most powerfully tend to its development; for we shall find that the female sex, as a rule, are much less exposed to these influences from the different character of their habits; besides which, a most powerful counteracting influence exists in the presence of the catamenial discharge, during a considerable portion of their lives. Sometimes, however, women are subject to genuine gout, although quite regular as to this discharge. I have seen patients so affected, and I have likewise been called in to attend cases where, at the time of pregnancy, the great toe and other joints have been severely attacked. I have also known women suffer under the most terrible forms of gout at an early age. We have already had occasion to refer to two such instances in our chapter on the chronic forms of this disease, cases in which the most fearful crippling of the patients had occurred from the extensive formation of chalk-stones.

Most of the cases which have come under my own notice, have been inherited, and in this country acquired gout among females is exceedingly rare. In the degenerate times of the Roman empire, however, when women gave themselves up to every kind of licentiousness, they appear, from Seneca's account, to have become the subjects of gout equally with men.

Women are more subject to the asthenic forms of gout, and also to the disease in its masked or irregular forms, which are very liable to appear shortly after the cessation of the menstrual discharge. In the French table before referred to, in 80 cases of gout, 78 of the patients were men, and 2 only women. As far as my own experience goes, I quite agree with the above statement, my results having shown that true gout, in its well developed articular form, is extremely rare among females, and this holds good in both hospital and private practice. To such an extent is this the case, that the influence of sex becomes a diagnostic mark between gout and rheumatism, for the latter is at least equally frequent in women as in men.

Influence of Age upon the Occurrence of Gout.—Youth, for the most part, enjoys almost complete immunity from gout. Hippocrates expressed his opinion on this subject in the following aphorism :—"Puer podagrâ non laborat, ante veneris usum;" and Sydenham states that he had never seen either gouty minors or gouty children; the most that he had observed was the slight foreshadowing of a future attack in the younger branches of gouty families. Heberden, again, never knew a certain case of gout before the age of puberty. On the other hand, instances are related in which it is said to have occurred in very young children, although I am of opinion that in many of these cases there is considerable doubt as to the correctness of the diagnosis; for in such subjects other joint affections, more especially rheumatism, may readily be mistaken for gout. Sir C. Scudamore was assured by a gentleman whose mother laboured under this malady, that he was attacked in the great toe at eight years of age, and medical friends have informed me of cases having occurred at a still earlier period of life. For my own part I confess I have not seen a case of true gout, that is, an articular affection specially implicating the great toe, in patients much under the age of twenty.

In 515 cases, the period of the first attack was noted by Sir C. Scudamore, and the results of his inquiry are seen below.

At the age of eight	1
,, twelve	1
,, fifteen	1
,, sixteen	1
,, seventeen	1
,, eighteen	5
,, nineteen	3
Between twenty and twenty-five years of age	57
,, twenty-five and thirty ,,	85
,, thirty and thirty-five ,,	105
,, thirty-five and forty ,,	89
,, forty and forty-five ,,	64
,, forty-five and fifty ,,	54
,, fifty and fifty-five ,,	26
,, fifty-five and sixty ,,	12
,, sixty and sixty-five ,,	8
At the age of sixty-six	2
	515

The author of the table, however, remarks that he himself had not witnessed many examples of a first attack before twenty, nor any after sixty-six.

It will be seen from the above, that in adult age, after the growth of the body is complete, and before the powers begin to decline, in by far the majority of cases, gout makes its appearance. When the age is measured by decennial periods, the greater number of cases are found to occur between the thirtieth and fortieth year.

Not long since I was called upon to treat a first and only attack of the disease, occurring at the age of sixty-nine or seventy years. The patient was suffering from valvular disease of the heart, accompanied with dyspnœa and anasarca, which were sometimes of much severity. Early one morning, and at a time when there was scarcely any swelling of the legs from anasarca, the ball of the left great toe became hot, red, swollen, exquisitely tender, and painful. After a few days the fit passed off in the usual manner, and was followed by free desquamation of the cuticle. During the time the gout was present, very marked relief in the breathing was experienced.

Sixteen is the earliest age at which any one of my patients could assure me they had experienced an attack of undoubted gout; and in the instance referred to, the disease followed the usual course, the intervals gradually lessening, until only a few months elapsed between the attacks, thus clearly demonstrating the nature of the malady.

Patients who inherit gout, suffer from its attacks at an earlier age than when it is simply acquired; for example, in the French table previously referred to, the mean age of the 34 cases of hereditary gout was 34 years, the extremes being 13 and 60 years: whereas in 43 out of the 46 cases of the acquired disease, where the age is noted, the mean is 38 years, the extremes being 27 and 50.

Between genuine gout and true rheumatism, such as is typified in cases of rheumatic fever, a marked distinction is seen in the influence of age, the former occurring most commonly for the first time after thirty-five, the latter seldom met with when that period of life has been attained.

Influence of Temperament or Constitutional Peculiarity on the development of Gout.—It must be remembered that the ancients, from the time of Hippocrates, held the opinion that there existed four kinds of humours in the human body,—blood, bile, black-bile, and phlegm, and that, as one or other of such humours was supposed to be present in excess, the individual was said to be of a sanguineous, bilious, melancholic, or phlegmatic temperament. These terms, though still often employed in medicine, are used with little precision, and much reliance cannot be placed upon the indications they are supposed to give. The term "nervous temperament" is also often made use of, and by it a peculiar irritable condition of the nervous system is understood to be implied.

With regard to the influence of the so-called temperament upon the occurrence of gout, I have not much information to offer, having derived little that is satisfactory from my own observation, and having met with the disease in individuals presenting every variety of bodily conformation. Acute sthenic gout may be said most frequently to occur in subjects of a sanguine temperament, and in those inclined to corpulency; but this latter condition has probably in many cases arisen from the same causes, which subsequently gave rise to the development of the malady in question, and cannot therefore be regarded in any way as producing it; the asthenic and irregular forms of this disease are perhaps more often seen in individuals of the nervous temperament and of a spare habit of body.

On this subject Dr. Cullen made the following observations. "If, with the ancients, we might ascertain by certain terms the temperaments of men, I could say that the gout attacks especially men of a choleric-sanguine temperament, and that it seldom attacks the pure sanguine or melancholic. It is, however, very difficult to treat this matter with due precision." And in another place he says, "It attacks especially men of robust and large bodies, men of large heads, and of full and corpulent habits, and men whose skins are covered with a thick rete mucosum, which gives a coarser surface."

In conclusion, we may with safety assert that fulness of habit accompanied with want of tone is a condition often found in gouty patients.

Influence of fermented and distilled liquors in inducing Gout.—There is no truth in medicine better established than that the use of fermented or alcoholic liquors is the most powerful of all the predisposing causes of gout; nay, so potent, that it may be a question whether the malady would ever have been known to mankind had such beverages not been indulged in.

A considerable difference, however, exists between these various fermented liquors in their power of inducing gout, and many interesting observations have been made, and numerous facts elicited, in relation to this point.

On first considering the question, it would be natural to suppose that, as the great peculiarity of all fermented liquors is in the alcohol they contained, their power as predisposing causes of gout would be in proportion to the quantity of spirit in their composition; but a more careful investigation of the subject fails to establish this supposition. Distilled spirits, when exclusively taken, appear to exert little or no power in inducing gout, whereas with wines, strong ales, and porter, the reverse holds good. This is at once made apparent by ascertaining, as far as we possess the requisite data, the frequency of the disease in different countries, and among different classes of individuals. In Scotland, for example, gout is rarely met with, very much less frequently than in England; and I have been assured by physicians of note in that country that they scarcely ever see a case, and when it does occur it is generally in the upper classes of society, and in large cities, where wines have been substituted, at least in part, for whiskey. Dr. Gregory, at the Royal Infirmary of Edinburgh, had only two cases of gout out of two thousand two hundred clinical patients admitted under his care; and Dr. Hamilton, though physician to the infirmary nearly thirty years, had likewise only two such patients during that period. I have also been recently informed by Dr. Christison, that although until within the last two years he had been physician to the Royal Infirmary of Edinburgh since 1827, he only met with two cases of gout, and both were in fat and over-fed butlers. The same remark equally applies to other Scotch cities, as Glasgow and Aberdeen. In Ireland, again, where whiskey is the principal alcoholic beverage, gout is little known.

It must not, however, for a moment be supposed that spirits are less pernicious to the system than wine: on the contrary, the occurrence of granular kidney, and dropsy, are exceedingly common among populations where large amounts of distilled spirits are imbibed.

Russians, Poles, and Danes, enjoy comparative immunity from gout, and distilled liquors are generally drunk by them; Van Swieten states that in Holland gout was but little known until wine was introduced as a substitute for beer, as may be seen in the following quotation:—

"Formerly, when a frugal manner of living was more in use among the Dutch, beer was the only drink; not only a smaller kind, which they used at meals, and when they were thirsty, but a strong, hearty sort, with which they loved to regale themselves in the evening, after the fatigues of the day. Wine was rarely or never used, even by those who could well afford it; and yet the gout hardly ever afflicted any that lived in this manner. On the contrary, I have observed a far greater number under the power of this malady, since the drinking plentifully of wine came more in fashion, the genteeler people having laid aside almost entirely the use of strong beer, leaving it to be drunk by the lower sort alone, whilst they themselves most liberally indulge in wine, especially at night, when, business being over, they give themselves up without restraint to the sociable enjoyment of their friends and glass."

Linnæus, from his observation upon the habits of the Laplanders, was inclined to regard wine as almost the sole producer of gout, seeing that the above mentioned people partook of malt-liquors, even plentifully, without so much as dreaming of such a disease.

The above statements of Van Swieten and Linnæus appear, to my mind, merely to show that wine is more powerful in producing gout than the beer which was drunk in those countries; but we shall soon have occasion to show that malt liquors, and more especially the stronger varieties, are most potent predisposing agents.

Many facts are on record showing the relative powers possessed by spirits, wines, and malt liquors, in this respect. Sir C. Scudamore, for example, gives an account of two patients illustrating the point. The first that of a strong and corpulent man, about 34 years of age, who, when he came under observation, had been subject to gout for five years. In the earlier part of his life he had been constantly on the sea coast as a smuggler, and at the time that he was exposed to the hardships of that irregular life, had drunk two or three pints of Hollands a day ; this was continued during a period of four or five years, simply with the effect of making him somewhat nervous and dyspeptic. He afterwards became a bricklayer, and being possessed of property, indulged both in wine and porter, taking only a small quantity of spirits, and in two years after he had commenced this new mode of living, in which he took much less than his accustomed exercise, gout came on.

In the second instance the patient lived in the country until he was 28 years of age, and partook freely of Hollands. He then engaged himself as a butler in London, and entered upon the usual inactive habits of such situations, indulging freely in wine and strong malt liquors. When he came under treatment he was 59 years of age, and during the last 24 years had had an annual attack of gout. It should be observed that in neither of the above mentioned cases did the slightest hereditary predisposition exist. Against these two instances it may fairly be urged that, with the change from spirits to malt liquors or wine, there was likewise considerable alteration in habits and occupations, and that the patients were approaching the age at which gout commonly manifests itself.

A striking example illustrating the same fact has been recorded by Dr. William Budd, who states that, "There is a body of men employed in the Thames whose occupation it is to raise ballast from the bottom of the river; as this can only be done when the tide is ebbing, their hours of labour are regulated by this circumstance, and vary through every period of night and day. They work under great exposure to inclemencies of weather; their occupation requires great bodily exertion, occasioning profuso sweating, and much exhaustion. In consideration of this, their allowance of liquor is very large, each man drinks from two to three gallons of porter daily, and generally a considerable quantity of spirits besides. This immoderate consumption of liquors forms tho only exception, as far as relates to food, which these men offer to the general habits of the lower classes, and, although not a numerous body, many of them are yearly admitted to the Seaman's Hospital Ship affected with that disease (gout). This is a very interesting fact, and seems to show that no amount of bodily exertion is adequate to counteract the influences of such large doses of porter; the exposure of ballasters to wet and moisture seems to favour its operation. These men are almost all derived from the peasantry of Ireland, they can rarely therefore inherit a disposition to gout."

My own experience of the relative power of alcoholic liquors in inducing gout amounts to this, that the wines ordinarily drank in this country, as port, sherry, and other stronger varieties, are the most potent in their operation; but the fact must not be lost sight of, that those who are in the habit of drinking much wine, are, at the same time, usually enabled to procure other delicacies, and especially the luxuries of the table, circumstances which greatly favour the development of the disease. A few years' liberal indulgence in port wine will often produce gout, where no trace can be discovered in any family branch. Even among the labouring classes this fact is occasionally observed, where, from the peculiar nature of their occupations, men have opportunity of taking wine in considerable quantities, as wine-bottlers, and others similarly engaged.

The lighter wines, as claret, hock, moselle, and even champagne, although capable of acting as the exciting cause of an attack in gouty subjects, have, when taken in moderation, but comparatively little inducing power, and probably in this respect, rank with the weaker kinds of malt liquors. The wine-drinking population of France, and Rhenish Germany, are but little afflicted with this malady, and the same is the case, to a great extent, with our own agriculturists. But when the finer qualities of these wines are freely partaken of, and especially if combined with excess of animal food, gout is by no means tardy in manifesting itself. In some of the larger cities of France and Germany gout is common, although considerably less so than in England, and any one who has visited Vichy during the bathing season must be at once convinced of the truth of this remark, at least as far as France is concerned. It is stated that in Bavaria and Berlin, where a large amount of beer is taken, gout also prevails.

Stout and porter rank next to wine in predisposing to gout, and some of the most severe and inveterate forms of the disorder I have met with in hospital practice have been in patients who had evidently acquired it from drinking this beverage, such, for example, as the cases occurring among the men connected with the great London breweries, and who not unfrequently drink an almost fabulous quantity of malt liquors. I have notes of the case of a man who, although but 28 years of age, was suffering, at the time he came under my care, from a severe form of the disease, attended with a deep-seated gouty abscess in the foot, and was assured by him that he had often drank as much as three gallons of porter during the day, and seldom less.

Strong ales, and even the ordinary bitter beers, so commonly used at the present day, exert a similar influence, as exemplified in the following instance. A patient, connected with a pale ale brewery, consulted me about five years ago, being then only 30 years of age; he had had his first attack of gout four years previously, at the age of 26, mild in character, and confined to the ball of the right great toe; three years afterwards he suffered from a severe fit of the disease, then implicating not only the toe but the ankle, heel, and knee; during the twelvemonth previous to my seeing him, the attacks had been much more frequent, occurring about every three months, at the same time they were assuming a somewhat chronic form. In this case no hereditary tendency could be discovered in any branch of the family, although carefully sought for, and the disease appeared to have been induced simply by the habit of repeatedly drinking pale ale in small quantities, although the total amount in the day was considerable. We shall again have occasion to allude to the above case when speaking of the influence of dietetic treatment upon the progress of the disease, which, in this instance, was very marked and satisfactory.

Cider and similar beverages will also act to some extent as predisposing causes of gout, and I am informed that in Devonshire the malady is by no means infrequent, although probably a much larger quantity is required than of the stronger kinds of malt liquors. Dr. Wood remarks that, as a *predisposing* cause, cider cannot be very potent, otherwise gout should have been more prevalent among the people of New England, and the middle Atlantic states, in which this drink was very commonly employed. Of the power of cider in *exciting* a gouty paroxysm, there can be no question.

Having fully determined the fact that the various alcoholic liquors possess different degrees of potency in causing the development of gout, it next becomes interesting to inquire the reason of such difference.

Why are distilled spirits less pernicious in this respect than those which have simply undergone the process of fermentation? Their influence certainly bears no direct ratio to the amount of alcohol contained in them; for the same quantity, which, in the form of port wine, is capable of developing the disorder, is completely powerless if taken in the form of whiskey; and the same holds good when the comparison is made between strong malt liquors and spirits.

Is there any known difference in the composition of these liquors to account for this?

Distilled liquors, as brandy, hollands, whiskey, gin, and rum, contain alcohol and water, sometimes united, with small amounts of colouring substances, and other matters to which their peculiar aroma and taste are due; the amount of absolute spirit varying in the different varieties from 40 to 70 per cent.

Wines, on the other hand, beside spirit and water, contain many other substances, as sugar, gum, extractive and albuminous matters; certain free acids, as tartaric, racemic, malic, and acetic; tartrate of potash, lime and magnesia; sulphate of magnesia, common salt, and traces of phosphate of lime; in addition to which, especially in the cellared wines, organic compounds which impart aroma, as œnanthic, acetic and other ethers. In some, tannic acid and colouring substances are also found.

As the nature and amount of these different principles are liable to considerable variation, some arrangement in groups may be advantageously adopted. They are thus classified by Mulder:—

1. Sweet, or liqueur wines, as Malaga, Tokay and Madeira; some of these are rich in sugar, but Madeira contains no excess of this principle.
2. Acid, or harsh wines, rich in tartaric acid, but poor in sugar, including the Rhine wines (Hocks), and Moselle.
3. Spirituous wines; as Portuguese (Port), Burgundy, and Sherry.
4. Wines containing tannic acid, including most of the French wines (Clarets), and resembling some in No. 3, with the exception of containing less alcohol.
5. Effervescing wines; as Champagne, and others.

As far as the quantity of alcohol is concerned,—

Port Wines . .	average of	11	kinds	= 19·3	per cent.
Madeira	,,	12	,,	= 19·1	,,
Teneriffe . . .	,,	12	,,	= 18·8	,,
Rhine Wines . .	,,	11	,,	= 10·6	,,

The amount of alcohol in Port wines varies from 17 to 21 per cent.; in Madeira the quantity is much the same; in Sauterne it varies from 12 to 15 per cent. In red French wines, from 9 to 14 per cent.; in good Bordeaux, 10, 11, and 12 per cent.; in Burgundy, 9, 10, and 11 per cent.; in Champagne, 10 and 11 per cent. In Rhine wines, 6 to 12 per cent., generally from 9 to 10 per cent.

As regards acidity, Dr. Bence Jones has ascertained that wines may be arranged in the following order, beginning with the least acid:—Sherry, Port, Champagne, Claret, Madeira, Burgundy, Rhine wines, and

Moselle. The least acid of all alcoholic fluids are Geneva and Whiskey, then Rum and Brandy, afterwards Ale, Porter, and Stout. All the wines are found to be more acid than malt liquors.

The following was ascertained to be the order in relation to the amount of saccharine matter, beginning with the least sweet:—Geneva, Rum, Whiskey, Claret, Burgundy, Rhine wines, and Moselle, have no sugar; then Brandy, Sherry, Madeira, Champagne, Port wine, Cider, Porter, Stout, Malmsey, Ale, Tokay, Samos, Paxarete and Cyprus.

Does our present knowledge of the relative composition of the different kinds of alcoholic liquors throw any light upon their varying powers of inducing gout? This, at least, is proved, namely, that it is not simply the amount of alcohol in the fluid, which determines the result, for we have shown that whiskey, and other distilled spirits, have little power; but at the same time it will be observed that the wines which are richest in spirit are most potent predisposers to the disease. This is particularly seen in the case of Port wine in this country. Sherry will also effect the same, although it is not usually drunk in the same quantities as Port.

The presence of acidity in alcoholic fluids cannot be looked upon as having any influence, seeing that Port and Sherry are among the least acid, and that strong malt liquors, which are usually freer from acidity than wines, possess much power; and on the other hand, the more acid wines, as Clarets and Hock, are comparatively harmless in this respect; but, in exciting a paroxysm of the disorder, it is probable that the amount of acidity is of much moment. The quantity of sugar can hardly be considered to exercise much effect, for it exists in large quantities in some of the most potent gout-inducing liquors, in small amounts in others, and certainly no direct ratio can be established between the presence of saccharine matter and the predisposing power of any alcoholic beverage.

But little is known respecting the saline matters of wines and other liquors; it is probable that the alkaline salts, especially those of potash, which are more abundant in the lighter wines, may in some way lessen their injurious effect; however, in the case of distilled spirits, this explanation does not obtain.

Are those spirits which possess little power as diuretics liable to produce gout? It was at one time thought that Rum predisposed to the affection, for Dr. Rush makes the following statement with regard to the influence of this, as well as other spirits. "I have heard of two or three cases of gout among the Indians, but it was only in those who learned the use of rum from the white people. A question naturally occurs here, and that is, why does not the gout appear more frequently among ourselves? To this I answer, that the effects of this liquor on those enfeebled people are too sudden and violent to admit of their being thrown upon the extremities, as we know them to be among the Indians. They appear only in visceral obstructions, and a complicated train of chronic diseases. Thus, putrid miasmata are sometimes too strong to bring on a fever, but produce instant debility, or death. The gout is seldom heard of in Russia, Denmark, or Poland. Is this occasioned by the vigour of constitution peculiar to the inhabitants of those northern countries? Or is it caused by their excessive use of spirituous liquors, which produce the same chronic complaints among them, which we said were common among the lower classes of people in this country? The similarity of their diseases makes the last of these suppositions the most probable. The effects of wine, like tyranny in a well-formed government, are first felt in the extremities; while spirits, like a bold invader, seize at once upon the vitals of the constitution."

From our present state of knowledge the following are the only conclusions which can be safely drawn in reference to this subject:—

1. Diluted alcohol in the form of distilled spirits, has little power in causing gout, at least in those who are not predisposed to it.

2. Alcohol when in combination with other substances, as occurs in wines and malt liquors, becomes a potent cause of gout, and the greater the amount of contained spirit, the more powerful the influence in producing the disease.

3. Neither the acid, sugar, nor any known principle contained in these liquors can as yet be proved to impart to the alcohol its predisposing influence;

for wines the least acid, and liquors the least sweet, are often among the most baneful.

To which we may add, with some probability of truth:

4. Alcoholic fluids which have little tendency to cause dyspepsia, and those which act more especially as diuretics, can, as far as gout is concerned, be taken with greater impunity than beverages of an opposite character.

Indigestion, animal diet and absence of exercise.—It is often a task of much difficulty to separate the effects of the above named influences, as dyspepsia is not uncommonly induced by partaking of too much food, and may equally be caused by a want of sufficient bodily exercise. Cullen remarked that gout seldom attacked persons employed in constant bodily labour, or those who live much upon vegetable diet, and few would feel disposed to differ from him in the general truth of the statement, for it is rare to find gout among a rural population, where much toil is endured, and where meat forms a comparatively small proportion of the diet; and, on the other hand, its occurrence is frequent among those who freely partake of highly seasoned dishes, and who are in the habit of consuming a quantity of nutriment far above the requirements of the system. This may be accounted for by the fact that an excess of food, more especially when highly nitrogenised, tends greatly to an increased formation of uric acid, which has already been shown to bear a close relation to the development of gout.

Not only does an undue amount of food powerfully predispose to gout, but also the manner in which it is assimilated ; for when the digestive function is imperfectly performed, the disease is more apt to become developed. Sydenham from his own experience came to the conclusion that gout proceeds from what he termed a weakened concoction both of the solids and fluids, and although we have already brought forward much evidence to show that defective excretion plays an important part in its production, we must still not lose sight of the very powerful influence of imperfect digestion and assimilation.

It next becomes of interest to inquire what are the varieties of dyspepsia, which, by long continuance, give rise to the gouty diathesis, and the development of the local affection. I believe the answer to be simple. Many of the forms of atonic indigestion are almost inoperative in this respect, as they merely prevent the proper formation of chyme, and hence impair the general nutrition of the body ; but those varieties of dyspepsia which lead to the excessive formation of uric acid in the system, likewise tend powerfully to the production of gout. Clinical observation has convinced me of the truth of this statement, for I find that in many cases of dyspepsia, the uric acid thrown out is even below the healthy standard, which we have assumed to be about eight grains per diem, but in other cases the amount is greatly augmented, as much as fifteen grains being sometimes eliminated each day; and it is in the latter cases only that we can anticipate the development of the disease, these varieties are generally accompanied with sluggish circulation in the portal system, and consequent congested liver.

It must be borne in mind that in gouty cases, especially where many attacks have already occurred, little can be determined with regard to the nature of the dyspepsia which laid the foundation of the disease; for as mal-assimilation may lead to the production of uric acid, so an excess of uric acid circulating in the blood may itself give rise to a secondary form of dyspepsia, and hence the cause of many of the premonitory symptoms referable to the digestive organs, which are so commonly met with in gouty subjects.

The more prominent symptoms of the dyspepsia connected with the uric acid diathesis, may, perhaps, be thus summed up: heartburn and eructations, oppression, and frequently sleepiness after food; a feeling of distension in the epigastrium, sometimes accompanied with tenderness; some fullness over the hepatic region, and the edge of the liver often projecting a little below the ribs, and occasionally tender to the touch; the tongue much furred, red at the tip and edges, a disagreeable and clammy taste in the mouth, and the saliva and buccal secretion occasionally more adhesive than natural. The bowels are usually more or less confined, scybalous, sometimes very dark in appearance, at other times light and clay-coloured, showing a defective secretion of biliary matter. Accompanying these symptoms there is generally a scanty secretion of urine, which is high coloured and acid, and often giving rise on cooling to a copious deposit of urates, or to a sediment of crystallised uric acid, varying from a brick-dust red to a pale yellow.

Influence of severe study and mental anxiety, &c., &c. —That the condition of the mind has a powerful influence upon the manner in which the functions of the various organs of the body are performed, is at once rendered evident by watching its effect upon the digestive and renal organs. It is not uncommon to find a severe fit of indigestion immediately following the receipt of painful intelligence, and most are cognisant of the intimate relation existing between the state of the mind and the secretion of the kidneys. As powerful and sudden influences rapidly effect very appreciable changes in the different functions, so those less marked act as surely, though often imperceptibly for the time, in altering the general nutritive processes of the body, and in the end may produce great and lasting mischief. Severe and prolonged study, which is almost necessarily conjoined with a sedentary life, tends greatly to lower the tone of the excretory organs, especially of the urinary, at the same time that it impairs the powers of digestion; hence ensues not only a defective excretion of some of the principles of the urine, but likewise their increased formation, circumstances powerful in engendering an impure condition of the blood. There are many cases on record among men eminent for their talents and application, which could be brought forward in proof of the influence of mental labour, both in causing the development of gout, and in exciting its attacks; but it will suffice to quote the words of Sydenham in his letter to Dr. Short, in which he says, "I send you a short tract upon Gout and Dropsy, instead of the thicker volume, which, in my own mind, I had determined on, viz., a history of such chronic diseases as my practice has most especially met with. By applying my mind, however, to its utmost, and by bringing all my powers of thought on the subject, I brought on a fit of gout, such as I had never before suffered from; so that the fact itself warned me to lay aside, even against my own will, such lucubrations, and to take care of myself; well satisfied with having, in some measure, dealt with these two diseases. Whenever I returned to my studies, gout returned to me."

In another part of the treatise above alluded to, the author states that more wise men than fools suffer from the disease, and from this and like evidence but one opinion can be arrived at as to the influence of severe and protracted mental exertion on the development of gout; at the same time I believe that such cause alone would be inoperative, unless aided by hereditary predisposition. In relation to this subject, Sir C. Scudamore remarks, that "the late Mr.

Pitt and his father suffered from gout at an early period of life. The father was a votary to Bacchus; of the son this could not strictly be said: but both were ardent students." It is also a well known fact, that in this country at least, cabinet ministers and politicians most distinguished by their talents and assiduous application, are frequently severe martyrs to the disease.

Other powerfully depressing influences, as sorrow, and chagrin, sometimes act in engendering a gouty habit, thus, reverses of fortune have been known to do so, although usually accompanied by circumstances which might be supposed to prevent its development; and the same has been asserted of other mental emotions.

The influence of venereal excesses in the production of gout was much insisted upon by early authors. Hippocrates' aphorism relating to this point is only so far true, inasmuch as development of this disease does not usually take place in early life; if the aphorism were literally correct, eunuchs should be altogether free, but Galen assures us that in the time of the Roman empire they enjoyed no exemption. Venereal excesses, like all other depressing agencies, lower the function of the nervous system, and hence favour the production of the malady, but their real influence is the more difficult to separate and define, inasmuch as they are frequently associated with immoderate indulgence in alcoholic liquors; hence the lines of the Greek poet in which gout is described as the daughter of Bacchus and Venus.

> *Λυσιμελους Βάκχου, και λυσιμελους Αφροδίτης*
> *Γέναται θυγάτηρ, λυσιμελῆς Ποδᾶγρα.*

In the treatment of the chronic forms of gout, it is of much importance that the effects of the various depressing causes we have described be not lost sight of.

Influence of climate and season.—It is a very difficult task to investigate accurately the real effect of climate upon the development of gout, for so many other influences are invariably connected with climate, that the separation of one from another is rendered almost impossible. There are, however, certain facts which appear to be well established in relation to this subject, of much interest, and not devoid of importance.

Gout is undoubtedly much less prevalent in hot, than in temperate climates. Among the natives in the interior of Africa, we are told by Dr. Livingstone that this disease, as well as calculus, is unknown; and I am informed that gout is not prevalent in the East Indies, except among European residents; the same remark applies to the natives of other tropical climates, for in Turkey, China, and Japan, it is scarcely known, and in Italy it is much less frequent than in France or England.

It would nevertheless be dangerous from these facts to draw the inference that this immunity is due to the effect of climate, for the inhabitants of the above named countries are either entirely, or almost, free from many of the predisposing causes of gout. They seldom partake of alcoholic liquors; their food is less nutritious, and contains less of nitrogen than that of nations in which gout is prevalent. We have also proof that other circumstances influence the development of gout more than mere climate, in the fact, that in Rome, under the republican form of government, the disorder was little known; but under the Empire, when luxury and indolence prevailed, it became extremely common, even among the female sex. We have already had occasion to allude to the circumstance of the disease being rare among certain other nations, as the Scotch, Irish, Russians, and Poles; but we have found good reason to ascribe the comparative immunity which the people of these countries enjoy, rather to their not partaking of strong wines and malt liquors, than to any effect peculiar to their climate.

The influence of season in determining the time of an attack of gout, rather than in producing it, is often well shown in the earlier stages of the disorder, when the intervals between the fits are considerable. In the spring the disease is most apt to occur, a fact known from the earliest antiquity. Hippocrates remarks, in one of his aphorisms, "Podagrici affectus vere et autumno plerumque moventur."

Galen also states that spring is the season when the return of gout is to be expected, and Sydenham considered that about the end of January, or beginning of February, the disease usually breaks out. The examination of a large number of gouty patients with reference to the time of year at which the first attack of the disease manifested itself, has satisfied me that the opinion of the ancients is correct. I have usually found that not only the first, but several of the early attacks, which, for the most part, are of annual occurrence, take place in the spring; after a time an autumnal fit is added, and when the disease has become more engrafted into the system, the returns of the inflammation may be more frequent and at irregular intervals.

As a general rule, even those who suffer from the more chronic forms of gout, are comparatively free during the hot months of summer, though occasionally well marked exceptions are found, and I have seen patients who endured even more in summer than at any other time of the year. Cœlius Aurelianus writes, "It seems not only to be produced at particular seasons, but also, in point of severity, to be very much influenced by them; as, for instance, in the spring it has the highest degree of severity, in autumn not so great, still less in winter, and hardly any at all in summer."

Influence of Lead as a predisposing cause of Gout.—It is a well-established fact that metallic impregnation is capable of inducing pains in the extremities, which bear a close resemblance to those of rheumatism, for artificers exposed to mercurial vapours often suffer from what is termed "neuralgia mercurialis," and plumbers and painters are afflicted with somewhat similar pains, which have been designated "lead arthralgia, or metallic rheumatism" by Sauvages. One peculiarity of the latter affection consists in the pain being severe, and following to some extent the direction of the large nerves, and not accompanied with tenderness, redness, or swelling.

The relation between lead impregnation and gout was not, I believe, made publicly known before 1854, when, in a paper read before the Medico-Chirurgical Society, and afterwards published in the Transactions,* I alluded to the curious fact, that a very large proportion, at least one in four, of the gouty patients, who had come under my care in University College Hospital, had, at some period of their lives been affected with lead poisoning, and for the most part followed the occupation of plumbers and painters. Since that date I have kept the subject prominently before my mind, and lost no opportunity of testing the correctness of my original statement; and, as far as hospital cases are concerned, have found the proportion of plumbers and painters quite as great among gouty patients, and in private practice and from many inquiries have ascertained that the followers of these trades are very frequently affected with the disease, much more so than other workmen in the same station of life. There appears to be nothing in the habits of these men capable of accounting for their peculiar liability to gout, with the exception of their being exposed to the influence of lead. Dr. G. Burrowes has informed me that, from his experience at St. Bartholomew's, he is convinced of the truth of the above statement, having himself for some time past noticed the great frequency of the disease among painters; other physicians have recently testified to the same effect.

---

* Medico-Chirurgical Transactions, vol. xxxvi., for 1854.

Some questions of interest in connection with this subject immediately suggest themselves to the mind. Can lead impregnation induce gout without the co-operative aid of other predisposing causes, and more especially the use of fermented liquors? And, granting the powerful influence of this cause, in what manner does it act in producing such results?

I am not prepared to answer the first question in the affirmative, but, at the same time, should hesitate to assert that the metal cannot of itself occasionally lead to the development of gout, as it would be necessary before doing so to determine certain difficult points; for example, whether in countries where gout is uncommon among the working classes, as in France and Scotland, painters and plumbers are liable to the disease. Tanquerel des Planches, in his "Traité des Maladies de Plomb," although he gives an account of a great number of patients who suffered from lead poisoning in its different varieties, does not allude to any of them having had gout. Dr. Williamson, of Aberdeen, has informed me that in that city gout is uncommon among the same class of men, and through the kindness of Dr. Christison I am enabled to give the results of that gentleman's valuable experience. In answer to some inquiries, Dr. Christison remarks as follows, "I am unable to supply you, from Edinburgh experience, with any information relative to the question, whether gout is apt to occur among those who are liable to suffer from exposure to the deleterious influence of lead. Poisoning from protracted exposure to lead is a very rare occurrence in Edinburgh. When I first became acquainted with the diseases of the working classes here, namely, in 1817, as clinical clerk, a few characteristic cases of lead-colic and palsy were annually admitted into the infirmary from a white lead manufactory carried on according to the old process at Portobello, a village three miles off. In a few years this source of supply ceased, in consequence of the owner of the works adopting the method of separating the white lead from the metallic plates, and subsequently grinding it under water. Not many years after that change, indeed, the manufactory was given up. Although I have been physician of the hospital from 1827 until two years ago, I have not seen a single case of lead-colic, or ordinary lead-palsy during all the intervening period. I can recollect two cases of wrist-drop in compositors, that is all. Among house-painters and plumbers, both of them numerous here, as they work extensively in the country around as well as in the city, I have never encountered a single instance of lead disease in any of its forms. I remember making inquiries about the effects of lead from an intelligent house-painter, who was my patient in the hospital for some other disease; and it appeared that he had never even heard of workmen in his trade being liable to any disease depending on exposure to lead. It is so far in accordance with your conclusions, that we know as little of gout, as of lead-disease, among our hospital patients. Gout occurs very rarely; I have known but two cases of it among my whole hospital service; both were in fat, evidently over-fed butlers. I was anxious to ascertain the cause of exemption of our painters and plumbers from lead disease, especially painters, who suffer from it so much elsewhere, even in London, for example. A journeyman, who had been a house-painter for seventeen years, a part of which he had spent in London, was well acquainted with lead-colic and lead-palsy, as occurring amongst his fellow workmen in the capital. He assured me that neither he nor any painter of his acquaintance in Scotland had ever known either disease among painters who had worked only in Edinburgh. He ascribed the difference between London and Edinburgh to the circumstance, that in Edinburgh they are never so far from their homes as to be prevented from going thither for their meals; that they therefore take off their working-dress, or overalls, and wash their hands and faces before going to meals; but that in London, workmen are so far from home or their master's establishment, that they cannot go home for breakfast or dinner; that they therefore take their meals where they work, and do not then take the trouble of changing their dress before they feed. This appeared to be a very feasible explanation of the difference, and various master painters and journeymen have since confirmed that man's account."

One circumstance, which appears to point to the conclusion that lead alone does not very powerfully predispose to gout, is the fact, that women engaged in white-lead manufactories, and who often suffer from colic, are not afflicted with gout in like ratio with men.

To ascertain the manner in which lead acts, I have been led to make several observations and experiments, which appear to throw light upon the subject; these have consisted, first, in ascertaining, in several instances, the condition of the blood and urine of patients under the influence of this poison, and secondly in determining the effect which lead, when administered medicinally, has upon the secretion of uric acid.

Case 1.—J. S. a man aged 44 years, by trade an organ-pipe maker, an occupation he has followed for twenty-nine years; he is in the constant habit of handling lead, as the pipes are composed of a mixture of this metal with tin and antimony. He has been accustomed to take a moderate amount of beer each day, but never in excess. Four years before his admission into the Hospital he had a slight attack of gout, confined to the ball of one great toe, and afterwards five or six similar attacks, but never of much severity; no hereditary tendency to the disease can be traced. Has never had a distinct attack of lead-colic, but about two years before I saw him had noticed a loss of power in his left arm, which gradually increased until complete wrist-drop ensued, accompanied with considerable wasting of the extensor muscles of the arm. The right wrist is at present also affected, though in a less marked degree; the flexor muscles are healthy. A distinct blue line is seen on the free edges of the gums, the countenance is somewhat sallow, and the mucous membranes pale and anæmiated. Some blood from a very small venesection exhibited the following characters:—

Clot natural in appearance; the serum, which was slightly turbid from the suspension of a little fatty matter, when treated with a few drops of acetic acid in a glass dish, with a fibre placed in it, in the manner described in Chapter 4, gave evidence of containing a large quantity of uric acid.

The urine was examined quantitatively for uric acid on three successive days, the whole amount being carefully collected, and the following results arrived at:—

January 28, 1859.—Urine, 46 fl. ounces; sp. gr. 1019 acid.
Uric acid eliminated in the 24 hours = 5·15 grain.

January 29.—Urine, 40 fl. ounces; sp. gr. 1020 acid.
Uric acid eliminated in the 24 hours = 5·68 grains.

January 30—Urine, 60 fl. ounces; sp. gr. 1015 acid.
Uric acid eliminated in the 24 hours = 4·08 grains.

Average daily excretion of uric acid = 4·97 grains.

Case 2.—R. T. a man aged 34, a painter and glazier, much in the habit of using white lead in his occupation. Within the last two years has had a painful affection of the right great toe, lasting a few days, and obliging him to give up work, but unattended with any marked swelling of the joint; has had two or three attacks of lead-colic, prior to the present. On admission into the Hospital, the gums were strongly marked with a blue line, and he was suffering from constipation and pain, with a twisting sensation in the abdomen. A small quantity of blood obtained by venesection presented the following characters:—

Clot normal; serum of a pale yellow colour, alkaline, and when treated with acetic acid, and a fibre introduced as described in Chapter 4, gave evidence of containing abundance of uric acid.

The urine voided when the attack of colic was passing off was pale yellow, clear, and on being acidulated with hydrochloric acid, gave rise to a deposit of rhombs of uric acid moderate in amount. A quantitative determination was not made.

Case 3, *Feb.* 3, 1859.—J. J., a man 42 years of age, a labourer, has always lived temperately, but with plenty to eat and drink. For the last four years he has worked at White Lead Mills, and after having been engaged in this occupation for eighteen months was attacked with colic, for which he was a patient in the Hospital for some weeks. Having returned to his former work, he was in about nine months again seized with lead-colic; five months after this he had a third attack, and the present, his fourth seizure, took place a few days before he came under my notice. On my first seeing him his condition was as follows: a well-marked blue line on the edge of the gums of both upper and lower jaw. Severe colic and constipation, with some vomiting, no loss of power in the wrists or hands. Pulse seventy-six and rather weak.

A small trial bleeding was ordered, to the extent of two ounces, and the blood serum when treated with acetic acid and the fibre immersed, gave evidence of containing a moderate amount of uric acid.

The patient had never experienced any symptoms of gout.

Case 4.—T. C., a man aged 46, under my care in October, 1858. A painter by occupation, which employment he has followed for twenty years, is temperate in his habits, takes a moderate amount of beer, lives comfortably, and is not much exposed to weather. About ten years ago suffered severely from colic, since which he has experienced three attacks, one very recently. Last winter felt some loss of power in his wrists and hands, and also symptoms which led him to suppose that he was about to have colic. Some medicine which he then took relieved him, and he went to work; the paralysis of the hands however continued to increase, and he is now unable to hold a paint brush so as to enable him to follow his employment. He has never had gout. At present, there is a blue line seen on the gums, but not very well marked, owing probably to the bad condition of the teeth; the right hand drops to a considerable extent, and there is a marked loss of power in most of the fingers; the left hand is much less affected. The extensors of the arm are small, compared with the flexor muscles. The patient is somewhat emaciated, but in other respects his general health is pretty good.

A very small quantity of blood, when examined, was found by the thread experiment to contain an abnormal amount of uric acid, the fibres, in two trials, becoming pretty freely sprinkled with the crystals of this body.

Case 5, *Feb.* 15, 1859.—J. B., aged 41, an artist, engaged in painting both in water and oil colours. About ten years since felt some symptoms arising from the absorption of lead, which at first manifested themselves as colicky pains in the bowels, and obstinate constipation; some impairment of vision and slight weakness of the wrists became also evident. These symptoms continued for a time, after which they were relieved, and he resumed his usual occupation. About three years ago he completely lost power over both his wrists, and had a severe attack of colic; he then came for the first time under my care, and by treatment was so far restored as to enable him again to pursue his avocations. Six weeks ago, he had a return of the wrist-drop and colic, which have continued up to the present time. There is now an entire loss of power in both wrists, which drop completely, also considerable wasting of the extensor muscles of the fore-arms, and of the flexor muscles of the right thumb; severe twisting pain around the umbilicus, and constipated bowels, loss of appetite, and weak pulse.

A very distinct blue line is seen on the free edge of the gums, both of the upper and lower jaw.

This patient had always lived temperately, never had decided gout, but often suffered from cramps in the legs; within the last few days the balls of both great toes have been tender, and a little swollen.

A small amount of blood, obtained on admission into the hospital, exhibited the following characters:

Clot firm, and slightly buffed;

Serum, yellow, transparent and alkaline. Sp. gr. 1027 at 60° Fahr. When treated with acetic acid, and the thread introduced, evidence of its containing abundance of uric acid was manifested.

Urine always pale, not giving rise to deposits, and yielding scarcely a trace of uric acid when acidulated with hydrochloric acid.

In the early part of the following June, this patient experienced a decided attack of gout, first in the metatarso-phalangeal joint of the left great toe, and afterwards in the corresponding joint of the right foot.

The results of the above five cases are conveniently exhibited in a tabular form :—

Case 1.	Wrist drop. Has had lead colic.	Within the last four years has experienced several slight attacks of gout.	Blood rich in uric acid. Average daily excretion of uric acid by kidneys = 4·97 grains.
Case 2.	Lead colic.	Slight threatening of gout in great toe but no attack.	Blood contained uric acid. Moderate amount of uric acid in urine.
Case 3.	Lead colic.	Never had gout.	A moderate quantity of uric acid in blood.
Case 4.	Wrist drop. Has had lead colic.	Never had gout.	An abnormal amount of uric acid in blood.
Case 5.	Wrist drop and lead colic.	No gout until after admission into the Hospital.	Uric acid abundant in blood, and very deficient in urine.

From the above it will be observed that uric acid is frequently present in the blood in cases of lead poisoning, not only in those who have previously suffered from gout, but even where no symptoms of the latter disease had ever shown themselves; and this fact is of much importance, inasmuch as its presence in abnormal quantities is excessively rare, except in cases of gout, as will be shown by observing the results of the examination of this fluid, which we shall have occasion to exhibit further on.

It will also be seen that there is some probability that the excreting power of the kidneys for uric acid is diminished by the influence of lead, a fact which we shall have an opportunity of illustrating by the effects produced by the medicinal administration of the salts of that metal.

Uric acid, however, is not contained in the blood in all cases of lead poisoning. I find that, among a set of my analyses published in the "Medico-Chirurgical Transactions" for 1854, one is stated to have been made in a case of lead colic, and with a negative result.

In October, 1858, I had an opportunity of making an examination of the blood of another case of the same disease. Case 6.—A man, J. C., aged 36 years, a labourer, temperate in habits, but taking two or three pints of beer each day. Has never had gout. During the last five weeks has been employed in a white-lead manufactory, where he was much exposed to the dust arising from the preparation. A few days before admission into the hospital he had noticed his bowels to be confined, and had felt pain in the abdomen, which gradually increased in severity. When admitted he complained of the above symptoms, accompanied with furred tongue, thirst, and loss of appetite. The blue line on the gums, both of the upper and lower jaw was strongly marked, and the inside of the lip also stained with sulphide of lead.

A small quantity of blood taken from the arm, carefully examined for uric acid by the thread experiment, gave no indication of that principle.

The above form the only well marked exceptions that I have met with, although I failed to detect uric acid in the blood of a man who came into the hospital for some muscular affection, and who had shortly before suffered from colic, supposed to be dependent on the poison of lead. The case, however, was by no means well marked.

I have had two opportunities of examining the effects of lead, when administered as a medicine, upon the secretion of uric acid by the kidneys, and the results, although requiring much further confirmation, are not without interest. The investigation of the subject, is beset with difficulties, as the cases in which the salts of lead are employed are not numerous, and it is only now and then that the urine is capable of being accurately collected from such patients. The first analyses were made on—

A man about 30 years of age, who had been passing for several days the following amounts of uric acid: 6·03 grains, 5·23 grains, 5·59 grains, 6·69 grains, and 8·98 grains, the average for the five days being 6·50 grains. Acetate of lead, in doses of four grains, made up into a pill with confection of roses, was then prescribed three times a day, and the amounts of uric acid passed the five following days were: 5·33 grains, 1·84 grains, 4·58 grains, 2·87 grains; the average being 3·65 grains (the result of the third day was lost from accident). The pills were only continued three days, as some nausea and sickness were induced. About a week after, a draught containing three grains of the lead salt dissolved in water, with a few drops of dilute acetic acid, was given three times a day. During the seven days that the medicine was taken, the daily amounts of uric acid were: 2·67 grains, 0·24 grain, 5·08 grains, 0·23 grain, 2·95 grains, 5·55 grains, and 1·93 grains, averaging 2·66 grains; during the next period of seven days, some slight tonic having been administered, the quantity of uric acid eliminated each 24 hours was: 7·45 grains, 6·21 6·18 grains, 5·23 grains, 6·17 grains, 8·58 grains, 12·69 grains, the average being 7·50 grains.

The next patient to whom the drug was administered was a young man about 19 years of age, who, for nine days prior to the administration of lead, passed the following amounts of uric acid each 24 hours: 7·68 grains, 7·70 grains, 6·53 grains, 6·50 grains, 8·64 grains, 5·24 grains, 5·85 grains, 6·84 grains, and 6·20 grains, averaging 6·76 grains.

During the next ten days, when he was taking two-grain doses of acetate of lead, three times a day, made into a draught with a few drops of acetic acid, the daily amounts of uric acid excreted were as follows: 4·74 grains, 1·92 grains, 5·62 grains, 7·56 grains, 3·34 grains, 7·80 grains, 6·07 grains, 9·27 grains, 6·40 grains, and 6·51 grains, averaging 5·92 grains.

It will be seen from these observations that in both patients a well-marked diminution of the excreted uric acid occurred under the influence of lead; in the first, this was most marked, being less than one-half of that passed when the metal was not administered. In the second it was also evident, though not considerable. In both cases, however, the occurrence of a very peculiar phenomenon was observed, namely, that after the drug had been given for a day or so, a sudden arrest of the secretion of uric acid appeared to ensue, and the function of the kidneys for throwing off this principle became more or less intermittent, as we have previously ascertained to be the case in patients labouring under gout.

It would appear, therefore, that in individuals impregnated with lead the blood is apt to become loaded with uric acid, not due to the increased formation of this principle in the system, but to its imperfect excretion by the renal organs. We have also adduced strong evidence showing that patients the subjects of lead poisoning are, *cæteris paribus*, more liable to become affected with gout than others not so circumstanced.

I have no evidence to prove that other metals possess a similar power to lead; that some may, is not improbable; there are, indeed, certain statements, of the truth of which doubt may be entertained, which would appear to show that lime exerts some influence upon the development of gout. It was remarked by Musgrave, that in Devonshire gout became frequent among the inhabitants when chalk was freely employed in agriculture, and physicians have made the same observation with regard to the island of Crete, and other countries; but at the same time it is not difficult to adduce strong evidence, showing the little power possessed by this supposed cause of gout. It is true there are certain chemical characters common to lime and lead, and even some physiological and therapeutic resemblances.

Exciting Causes of Gout.—Several of the causes of gout, which we have now considered will, if at any time suddenly increased in intensity, act in immediately exciting a fit of the disease; there are others which, although potent as exciting, are altogether powerless as predisposing causes. The amount of an exciting cause necessary to produce an attack depends greatly on the proneness of the patient's system to take on gouty action, and we frequently witness examples of an attack of gout apparently produced in one individual by a trivial irregularity, which in another would be productive of no inconvenience; it will be found also, as we proceed, that causes which are capable of exciting an attack, unlike those which induce the disease, are to a great extent dependent upon constitutional peculiarity; thus, in one case exposure to cold; in another, a fit of indigestion; in a third, some shock to the system; will act as the exciting agent.

Alcoholic Beverages.—One of the most common exciting causes of an attack of gout is the drinking an unusually large amount of an alcoholic fluid, or the partaking, even in moderation, of certain wines, such as champagne, or malt liquors which have become a little hard from the formation of acidity; so potent, indeed, is the influence of special wines on certain patients, that some cannot take a single glass of champagne without the occurrence of a fit of gout as an almost immediate consequence; in others, port wine acts more powerfully, the cause of such differences appearing to depend on peculiarities of the digestive and assimilating functions. I have met with many instances illustrating the effects of both the above-named wines, and likewise of strong ale. I lately saw a gentleman with his first attack of gout, evidently excited by taking a somewhat unusual amount of exercise, and drinking freely of beer. Cider and perry will occasionally act in a similar manner.

Sir C. Scudamore gives several instances showing the power of some of these alcoholic fluids in exciting gout. One gentleman, disposed to gout, but never having experienced an attack in the summer season, induced a fit by taking six or seven glasses of champagne. Another was sensible of gouty pains in his limbs before quitting the dinner-table, from partaking of the same wine. A third brought on a most severe fit by indulging for a short time in French wines; a fourth found his great toe hot, throbbing, stiff, and painful, when he drank port wine, even sparingly, for a week; and lastly in a patient, subject to gout in a very slight degree, pricking pains in the toe immediately occurred after taking two glasses of port wine.

These instances might be multiplied almost indefinitely, for every physician who has had the opportunity of seeing much of this disease could relate examples fully confirming what has been stated. In fact, the knowledge of this power of alcoholic stimulants in immediately exciting a gouty paroxysm, can occasionally be usefully employed in diagnosis; and I believe it may be safely asserted, that *when the partaking of a few glasses of wine, ale, or porter is capable of at once inducing an inflammatory disease in a joint, such affection is of a true gouty character.*

Dyspepsia is another powerful exciting cause of a gouty paroxysm, and not unfrequently we meet with patients who attribute their attacks to the partaking of certain articles of diet which have induced disturbance of the digestive organs, and more especially such as lead to the production of acidity. Overloading the stomach with a variety of highly-seasoned and indigestible dishes, taking different varieties of alcoholic beverages at one meal, which appears to be more injurious than the same amount of any one kind; and, in fact, anything which produces a fit of indigestion, may be soon followed by a gouty paroxysm. Temporary congestion of the liver, leading to an alteration in the secretion and flow of bile, may also be attended with like consequences.

I have known a severe attack of gout brought on by the production of indigestion from taking a hot bath soon after a full meal; and as showing the influence of acids and indigestible articles of food in exciting gouty symptoms, Dr. Petit remarks that Dr. Guersent told him that whenever he partook of citron, his joints, usually a little tender, became so troublesome as to prevent his walking without much inconvenience; and Larry asserted that he had seen a man who, whenever he drank lemonade, felt sharp pains in the joints of his lower extremities, which remained many hours. Another patient informed Dr. Petit, as the result of frequent experience, that he was certain to bring on an attack of gout by eating *"des pommes au beurre,"* especially when the fruit was unripe and acid; and, lastly, the same author relates an instance of a gouty priest, who induced an attack of the disease twice in one year, the day after partaking of the dish called *"du veau à l' oseille."*

Cold and moisture, although incapable of inducing a gouty diathesis, or leading to the production of gout, will in many subjects act powerfully as exciting causes. I have attended several patients in whom this fact was well exemplified, and cases in which there could be no possible doubt of the real nature of the malady under which they laboured. In one instance, a gentleman in whom the disease commenced in the ball of the great toe, and always presented the characteristic phenomena of true gout, and whose blood was likewise proved to be loaded with uric acid, the attacks were always excited by easterly winds, and in no way connected with any appreciable disturbance of the stomach or bowels. The local application of cold, as getting the feet wet, will often prove sufficient to excite a fit in gouty persons, and among the lower classes these causes are frequently operative, even when not accompanied with indulgence in alcoholic liquors.

When cold becomes an exciting cause of gout, the effect is due, at least in part, to its arresting the secretion of the skin, and by checking the escape of acidity which is usually thus eliminated, the blood is rendered less alkaline in reaction; at the same time, it must be remembered, a chill to the surface is necessarily accompanied by congestion of the internal organs, leading to functional derangement and an alteration in their various secretions. Cold may also occasionally act by its depressing influence upon the nervous system, which of itself so frequently leads to a gouty paroxysm.

Severe mental or bodily labour, or sudden depression from any other cause, and, in short, anything which lowers the tone of the nervous system, is prone to induce a fit of gout, and some patients are peculiarly liable to be thus affected.

Sitting up late at night, especially when combined with severe study, will often occasion an attack. Van Sweiten relates the case of an eminent mathematician, who brought on a fit by the long and constant application of his mind to the solution of a difficult problem; and Sydenham, as we have before noticed, always induced an attack of gout when devoting more than usual attention to the composition of his Tract upon the disease in question. Violent excitement, or rather the depression which follows such excitement, likewise anxiety and other mental shocks, may be productive of the same, as is often seen after a fit of anger. Great bodily fatigue also, as a long walk, is sometimes followed by a fit in subjects predisposed, and the same may result from a severe blow, fall, or other injury; many examples are on record in which fractures of limbs, dislocations of joints, surgical operations, have been followed by an attack of the disease. Local injury not only acts in exciting gout, but frequently determines the situation or locality of the inflammation; thus, an injury to the knee or ankle will usually cause these joints to be primarily affected, although the great toe or some other part may subsequently become implicated.

The occurrence of hemorrhage may also act as the existing cause of a gouty fit, and the effect is then probably induced by the depression of the system arising from the loss of blood. Many examples clearly proving this statement have occurred in my own practice. I have seen, for example, a first fit of gout produced in a lady by copious hematemesis; also attacks in other gouty patients caused by loss of blood from a tooth, as well as from epistaxis and other forms of hemorrhage. On the other hand, it is not uncommon to find the suppression of an ordinary discharge of blood, as the sudden stoppage of the catamenia, immediately followed by a paroxysm. M. Duringe relates the case of a lady in whom the cessation of the catamenia, caused by a violent fright, was followed by several attacks of gout, which ceased when the patient again became regular. Instances illustrative of the effects of the suppression of an habitual hemorrhoidal discharge are by no means uncommon.

The depression of the system caused by any exhaustive disease will often induce a fit of gout, and several instances of its occurrence during the recovery from boils and carbuncles have come under my notice.

In concluding this part of our subject I may remark, that it would appear that all causes leading either to the increased formation of acidity and its accumulation in the blood, or to the suppression of the natural acid secretion from the skin, and, lastly, all causes depressing the nervous energy and inducing defective excretion, have a powerful influence in exciting an attack of gout in subjects already predisposed to the disease.

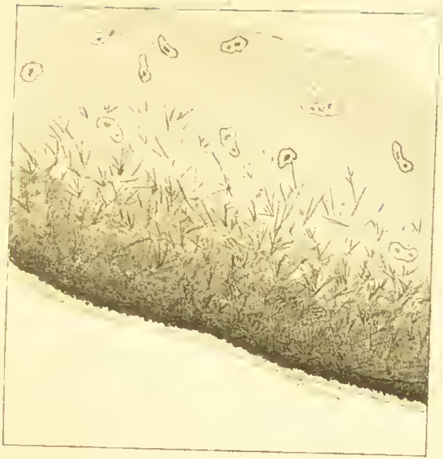
CHAPTER IX.

PATHOLOGY OR NATURE OF GOUT :—EVIDENCE OF A CLOSE RELATION BETWEEN GOUT AND URIC ACID—CHARACTERS AND COMPOSITION OF URIC ACID AND ITS SALTS—PRODUCTS OF ITS METAMORPHOSIS UNDER DIFFERENT CIRCUMSTANCES—ITS OCCURRENCE IN DIFFERENT CLASSES OF ANIMALS—ITS PHYSIOLOGICAL AND PATHOLOGICAL RELATIONS—OPINIONS OF THE ANCIENTS ON THE NATURE OF GOUT —CULLEN'S OBJECTIONS TO THE DOCTRINE OF THE HUMORAL PATHOLOGISTS, AND HIS OWN VIEWS ON THE SUBJECT—MURRAY FORBES' THEORY—OPINIONS OF SIR C. SCUDAMORE, DR. BARLOW, DR. GAIRDNER, AND OTHERS—REFLECTIONS OF SIR H. HOLLAND—AUTHOR'S OWN VIEWS ON THE NATURE OF GOUT—EXPLANATION OF THE GOUTY DIATHESIS AND PREMONITORY SYMPTOMS—EXPLANATION OF THE PAROXYSM AND VARIOUS PHENOMENA CONNECTED WITH THE DISEASE.

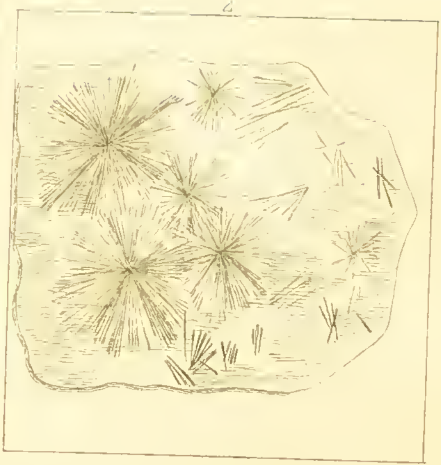
HAVING passed in review the phenomena ordinarily presented by gouty subjects, at least by those labouring under the more typical forms of the disease; having also ascertained the peculiar alteration of the blood and urine and the morbid changes exhibited by the different tissues affected with gouty inflammation; and lastly, having studied the causes which act most powerfully both in predisposing and exciting the malady, we are prepared to enter upon an investigation of a very difficult character, that of attempting to determine the true nature or essence of gout.

From a perusal of the contents of the preceding chapters, more especially such as relate to the altered

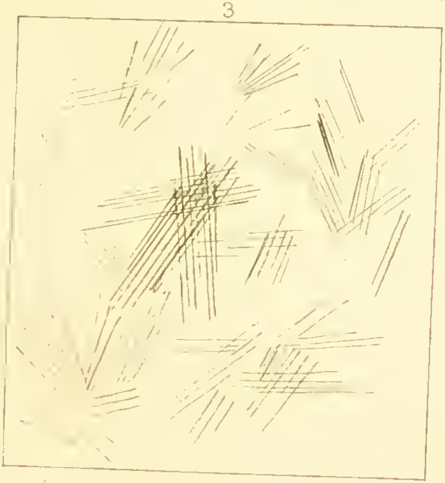
1



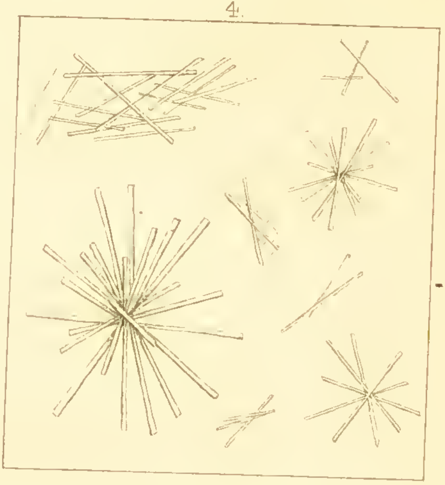
2



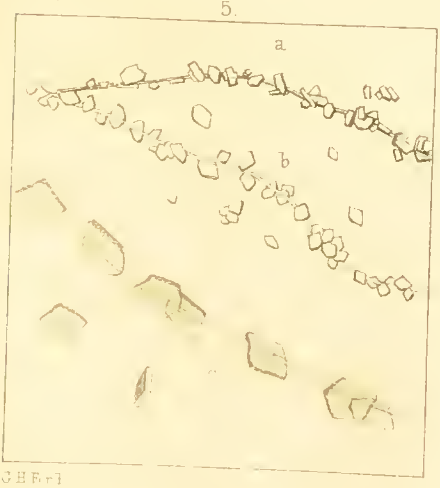
3



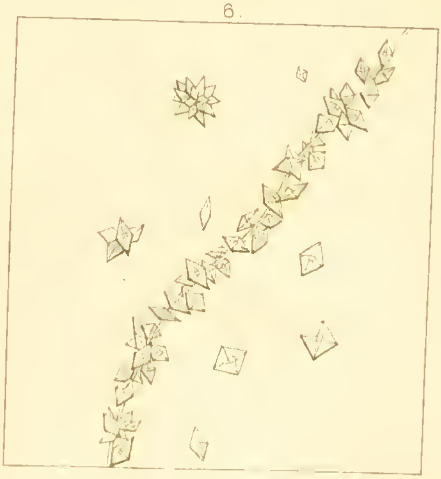
4.



5.



6.



G.H.F. del.

W. West imp.

composition of the blood, and the chemical characters of the external deposits occurring on gouty patients, and of the matter infiltrated in the tissues in and around the joints, the reader cannot fail to have remarked, whatever may have been his previous views of the pathology of the affection, that a very intimate relation, of necessity, exists between uric acid and the disease in question; and such being the case, it will be advantageous to give a slight sketch of the nature and composition of this acid, and its relation to the organism in the different classes of animals, and under the varying circumstances of health and disease.

Uric acid, or lithic acid,* as it was at one time called, occurs when perfectly pure, as small white glistening plates, consisting of flattened rhombic crystals, sometimes so fine as to give it the appearance, to the naked eye, of an amorphous powder, but when examined by the microscope, its crystalline structure will be at once recognised, and the forms then presented are depicted in Plate V. fig. 5, and Plate VI. fig. 1. Although quite white when separated from the urine of serpents and birds, in which the renal secretion is devoid of colour, yet, as commonly procured from human urine, it has a yellowish or red tint, depending on the great affinity possessed by this acid for colouring matters, and its power of carrying them down when precipitated from any coloured fluid. The solubility of uric acid in water is extremely limited; it requires, according to Dr. Prout, at the ordinary temperature of 60° Fahr., as much as 10000 times its weight of water, and even 15000 times, according to other observers; in boiling water it is more soluble, dissolving in about 1800 parts. Although possessing the chemical properties of an acid, its watery solution does not give the reaction to litmus paper. Uric acid is insoluble in alcohol or ether, somewhat more soluble in dilute hydrochloric acid than in water, and pretty freely soluble and without decomposition in strong sulphuric acid, but again separated when the latter is diluted with water. In many saline solutions uric acid dissolves readily, as for example, in fluids containing the alkalies, and their carbonates, as urates of these bases are then formed,—salts more soluble than the acid itself. Uric acid is also rendered more soluble by means of the phosphate or bi-borate of soda; with the former salt, which is naturally strongly alkaline, it is found to induce an acid reaction, a phenomena resulting from the formation of the urate of soda, and the simultaneous production of the acid biphosphate of soda.

---

* Uric acid was first discovered in urinary calculi and urine by Scheele, in 1776; it was called lithic acid by Morveau, but afterwards named uric acid by Fourcroy, by which designation it is commonly known at the present day.

The composition of uric acid may be represented by the formula—

$HO, C_5 H N_2 O_2$, or as a bibasic acid by $C_{10} H_4 N_4 O_6$, or $2 HO, C_{10} H_2 N_4 O_4$, the water in the latter formula being considered as basic, and capable of being replaced in whole or in part by other acids, forming two classes of salts, one termed neutral, the other acid or bi-salts.

The salts of uric acid which possess most interest to the physiologist and pathologist are represented in the accompanying Table, in which their composition and solubility are likewise appended.

Bi-urate of soda . . . . $HO, NaO, C_{10} H_2 N_4 O_4 + HO$. Soluble in about 124 parts of boiling water and 1150 parts of cold water, 60° Fahr. This salt exists in urine and gouty blood, is also deposited within the tissues of gouty subjects. Crystallises in six-sided prismatic needles, frequently radiating from a centre.

Bi-urate of ammonia . . . . $HO, NH_4 O, C_{10} H_2 N_4 O_4$. Exists sometimes in urine and urinary calculi, and birds' and serpents' urine. Crystallises in needles and rounded masses, with projecting spiculæ, soluble in about 1600 parts of water at 60° Fahr., more soluble in hot water.

Bi-urate of potash . . . . $HO, KO, C_{10} H_2 N_4 O_4$. Soluble in 700 parts of cold water, about 65° Fahr., and in 79 parts of boiling water.

Bi-urate of lime . . . . $HO, CaO, C_{10} H_2 N_4 O_4 + 2 HO$. Dissolves in 603 parts of cold water.

Bi-urate of magnesia . . . . $HO, MgO, C_{10} H_2 N_4 O_4 + 6 HO$. Dissolves in about 160 parts of boiling water, and in 3750 parts of cold water. Crystallises in needles.

Bi-urate of lithia . . . . $HO, Li O, C_{10} H_2 N_4 O_4$. Its solubility is much greater than any other known urate, but has not as yet been accurately determined. It crystallises in long prismatic needles.

The neutral urates of these bases, with the exception of those of ammonia and magnesia, can be artificially obtained ; but, as they are decomposed and converted into the bi-urates by the action of carbonic acid, which abstracts half the combined base, and cannot therefore exist in the fluids of the animal body, they possess comparatively little interest in a physiological or pathological point of view.

Uric acid, when acted upon by oxidising agents, is disintegrated or broken up, and some of the modes of its decomposition are of considerable interest to the pathologist; thus, when boiled in water with the puce-coloured or binoxide of lead, the products of its decomposition are urea, oxalic acid, and allantoin, the latter a principle contained in the allantoic fluid of the cow, and little doubt can exist of such a metamorphosis often occurring in the animal economy: Wöhler, for example, found that when a solution of the acid was injected into the veins of a dog, oxalic acid appeared in the urine; and we frequently see in urinary calculi from the human subject alternate layers of urate of soda and oxalate of lime; and often in patients in the habit of passing urine giving rise to a urate deposit; slight circumstances, as change of weather and differences of diet, will cause the urates to be suddenly replaced by a crystalline deposition of oxalate of lime.

When uric acid is submitted to the action of nitric acid of varying strengths, different principles, as alloxan, alloxantine, are formed, and from these, with the addition of ammonia, the beautiful colouring matter murexide, or purpurate of ammonia, can be obtained, the production of which forms so valuable a test of the presence of the acid. When uric acid is subjected to the action of a high temperature, as during dry distillation, the products of its decomposition are urea, prussic acid, and carbonate of ammonia; and when decomposed by fusion with a caustic alkali, cyanogen compounds are likewise produced.

The physiological and pathological relations of uric acid, as far as they are at present known, may be thus shortly enumerated. It is a constituent of the urine of the human subject in health, and the daily amount excreted by the kidneys may be estimated at about eight grains. It is also contained, as shown in Chapter IV., in the merest traces in healthy blood, though often very difficult to demonstrate there on account of the minuteness of the quantity. It has likewise been shown by Scherer to be contained in the spleen. In the urine of many other animals it is a normal constituent, sometimes existing in small amounts only, sometimes forming the chief ingredient of the excretion. It appears to exist in minute proportions in the urine of the gramivorous mammalia, as in that of the ox and cow, as asserted by Fownes, Bödeker, and Brücke, and in that of the calf, according to Wöhler; in the carnivorous mammalia it is present in amounts usually much greater than in gramivorous, though in smaller quantities than in man; but the correct estimation of uric acid in the urine of these animals is attended with much difficulty, as when opportunities of making the examinations occur, they can scarcely be considered, from the influence of confinement, to be in a natural state. Uric acid has been discovered by different observers, especially by Hieronymi and Vauquelin, to be a constituent of the urine of the lion, tiger, leopard, panther, bear, hyena, wolf, and dog; but in the pig's urine it has not yet been discovered.

In the urinary secretions of birds, it is a very large and constant constituent, forming the principal ingredient of the semi-solid white substance which is seen to invest their excrements. When chemically examined, this white matter is found to consist of urate of ammonia, or more strictly speaking the acid or bi-urate, and under the microscope is observed to be composed of minute spherical or oval masses, having the appearance represented in Plate VI. fig. 2 (b), a drawing taken from the urine of the pigeon: the same is exhibited by the urine of all birds, and the size of the masses appear from my observations to be about the same, whether derived from the largest species of birds, as the ostrich, or the smaller kinds, as the canary. These oval masses are crystalline in character, depolarise light, exhibit lines radiating from a centre, and frequently wedge-shaped indentations are visible, as shown in the drawing. The appearances above alluded to are not confined to birds, but found also in the renal secretion of reptiles and many of the invertebrata. I may remark that in birds the semi-solid urine seems to contain little more than the urate of ammonia, combined with water. No trace of urea is ordinarily present, but this principle is asserted by Coindet to be a constituent of the excretion of carnivorous birds. Guano, which is the excrement, or rather the urine of sea birds, is also rich in uric acid.

In the urine of reptiles, uric acid is an abundant ingredient; the urine of the boa constrictor and python forming the chief source of the uric acid of commerce. In the ophidians, as in birds, almost the whole mass of the urine consists of urate of ammonia, no urea being usually present; but on one occasion, I found this principle in the fluid portion obtained from the common green snake.

The urine of most saurians is rich in urate of ammonia, for it has been found in the crocodile, lizard, and iguana. In the chelonian reptiles, as the tortoise and turtle, it is likewise present.

The different statements which have been made as regards the urine of the tortoise are easily explained. One observer, for example, has asserted it to be rich in urate of ammonia; another, free from this salt; and the discrepancy evidently depends on the state of the animal in relation to food. When a tortoise has not taken nourishment for some months, as in the early spring, the urine is usually clear, and gives rise to no deposit, but is rich in urea; but when nourishment is freely taken, the urine becomes creamy in consistence, and contains, in addition to urea and hippuric acid, a large amount of urate of ammonia in the form above described.

In fish the composition of the urine has been but little studied, but some observers have noticed the presence of uric acid; probably it resembles that of reptiles.

In the invertebrata the presence of uric acid or urate of ammonia is almost constant; thus it has been discovered in the silk-worm, butterfly, and house-fly, also in the moth, caterpillar, beetle, grass-hopper, cricket, Spanish fly, and many species of Meloë; indeed it is probable that the nitrogenised excretion of invertebrate animals is chiefly in the form of this compound.

From the above it will be observed that the occurrence of this acid throughout the animal series is very constant, although the proportion in which it is thrown out is liable to extreme variation, sometimes forming almost the sole nitrogenised excretion, at others a mere indication of its presence being all that is capable of being discovered.

The amount of uric acid excreted by the human subject is liable to much variation, and such differences may arise not only from the presence of disease, but also from circumstances in no way incompatible with the existence of perfect health. It is essential that we should bear in mind that the indication afforded by the secretion of this acid cannot always safely be taken as an index of the quantity formed in the system, for the kidneys may lose their power of eliminating it by the urine at the time that it exists, even in abnormal proportions, in the blood; a fact which has been proved beyond doubt in the preceding pages, and which is of much importance in considering the pathology of gout.

Among the circumstances especially influencing the amount of uric acid, may be mentioned the character of the food, the time of its exhibition, and the perfection of its assimilation by the digestive organs. That the formation of uric acid is much altered by the nature of the food is made evident by the result of some experiments made by Boussingault, in which he ascertained that ducks fed with different substances excreted varying amounts of this acid in the twenty-four hours. For example—

When no food was administered, the quantity thrown out was . . .	4·163 grains.
When balls of clay were exhibited the amount was also	4·163 ,,
Under a diet consisting of gum . .	4·412 ,,
When casein was given	162·4 ,,
Under a gelatine diet . . .	157·08 ,,
Ditto, in another trial	203·28 ,,
Under a diet consisting of fibrine . .	138·6 ,,
Ditto, of flesh	291·0 ,,

Although Boussingault's results show that the uric acid is evidently derived mainly from the administration of food, less than five grains being excreted by these animals when fasting, or when substances containing either no nutriment or non-nitrogenised ingredients were given, still we have abundant proof that animals living on a vegetable diet and one containing but little nitrogen will still eliminate a considerable amount of uric acid. A tortoise, feeding on lettuces for example, will throw out the semi-fluid urate of ammonia in considerable quantities, but still this is derived from the nitrogenised principles contained in the plant which is devoured by these animals in great abundance.

Lehmann's trials on his own person lead to a similar result, but at the same time show that the nature of food influences the secretion of uric acid in the human subject much less than that of the urea. This observer found that he passed in the twenty-four hours[*]:—

On a strictly vegetable diet . .	15·5	grains	of uric acid.
On a mixed diet . . .	17	,,	,,
On a strictly animal diet . .	21·5	,,	,,

It seems probable that if the diet be such as to be exactly sufficient to keep up the proper nutrition of the body, and there be no redundancy of food, that the amount of uric acid secreted would be, *cæteris paribus*, about the same, whatever the nature of the diet, assuming, however, that it be of a wholesome character, the stomach in a condition to digest it completely, and the individual in the enjoyment of perfect health.

Any circumstance leading to imperfect digestion and assimilation, whether it depends on the nature of the food, or the condition of the assimilating organs, may at once alter, not only the absolute formation of uric acid, but likewise its relation to the other solid ingredients. Lehmann, for example, found in a normal condition the ratio of uric acid to the urea was 1 to 28 or 30, and to the rest of the solid matter of the urine as 1 to 60; but in indigestion, the uric acid was to the urea as 1 to from 23 or 26, and to the rest of the solids as 1 to from 41 or 52.

---

[*] It will be observed that Lehmann secreted an amount of uric acid far above the average we have adopted ; this he accounts for by stating that he was labouring under some softening of the pulmonary tissue.

The relation of the uric acid to food is also well shown by the experiments of Dr. H. Bence Jones, but these indicate rather the immediate effect of diet than the absolute influence, and show that during the time the food is undergoing the process of digestion the amount of uric acid eliminated by the healthy subject is at its maximum.

> Before taking food, the urine was of sp. gravity 1024, and 1000 grains yielded 0·049 grains of uric acid.
>
> After animal food, the urine was of sp. gravity 1027, and 1000 grains yielded 1·022 grains of uric acid.
>
> After vegetable food, urine sp. gr. 1025, and 1000 grains yielded 1·010 grains of uric acid.

It is a matter of extreme difficulty to discover the many causes which affect the formation and secretion of uric acid, and before we can hope to throw much further light upon the subject many new and extended investigations are required.

It was assumed by Liebig that the function of respiration possessed much influence, and in proof of this hypothesis the fact was brought forward that the carnivorous mammalia excreted very little uric acid, whereas ophidian reptiles living on similar food, threw out enormous quantities of the same acid. In the former class of animals the respiratory function, and consequently the amount of oxygen consumed is very great, whereas in the latter it is at an exceedingly low ebb.

The chemical explanation of this supposed action of oxygen was likewise very simple, and accorded well with the known influence of oxidising agents in breaking up uric acid into less complex organic compounds, more especially urea—decompositions which we have already had occasion to illustrate in the present chapter.

Unfortunately for this theory, which at first sight is very attractive, many facts can be adduced which must at once show its fallacy, for we have only to consider the character of the urinary secretion in birds and insects to be convinced of its utter inefficiency to explain the phenomena. The urine of birds and insects consists chiefly of urate of ammonia, and yet their respiratory function is extremely active, and the amount of oxygen which they consume compared with the weight of their bodies, perhaps greater than in any other class of animals. It may be that, *cœteris paribus*, the amount of oxygen consumed has some relation to the excreted uric acid, but certainly under varying circumstances, and in different animals, the existence of this relation cannot easily be demonstrated.

In the investigation of the amounts of uric acid secreted in different diseases, too many other disturbing causes beside the mere alteration of the respiratory function have to be taken into account to allow us at present to lay much stress upon the results; as a rule, in febrile and inflammatory affections there is an augmentation of this principle, and more especially when the liver and spleen, or any organ connected with the portal circulation, are implicated.

The condition of the cutaneous function has generally been supposed to affect the secretion of uric acid, an opinion strengthened by the fact of the appearance of deposits of urates when a patient is under the influence of a cold, also from the circumstance of the frequent occurrence of urinary calculi, composed either of this acid or its derivatives, in the eastern counties where the influence of the bleak north-east winds is so keenly felt. Probably the function of the skin may possess some power in altering the formation of uric acid, but its chief influence is undoubtedly exerted in altering its state of solubility in the urine. Suppressed perspiration is immediately followed by an increase of urinary acidity, and hence by the precipitation of the uric acid either in the form of urate of soda, or more commonly in a free and crystalline state.

Exercise likewise influences the formation and excretion of uric acid, but its exact effect has not yet been clearly defined. Lehmann found that when under active exertion the ratio between the uric acid and urea in his own urine became much lessened; when at rest, and under a fixed diet, it was as 1 to 38, but after considerable exercise the ratio was as low as 1 to 77.

There is every probability that not only the relative but the absolute secretion of uric acid would be lessened by active exercise, but we must remember that the digestive and other functions are at the same time influenced.

We have already had occasion to observe that the ancient physicians were well acquainted with most of the phenomena of gout, and they likewise speculated to some extent on the intimate nature of the disease; but being entirely ignorant of the peculiar changes in composition and structure which ensue in the different fluids and tissues, they had no opportunity of arriving at its true pathology.

The ancients were chiefly humoralists, and looked upon gout as produced by some morbid condition of the blood, but the particular nature of the alteration was regarded differently by various writers, some considering it due to the presence of phlegm, others to bile, and a third to a mixture of these fluids. Chalk stones or gouty tophi were viewed as due to their exudation and concretion. The ideas on this subject entertained by several of the principal ancient authors, as Galen, Aretæus, Cælius Aurelianus, Alexander, Aëtius, Paulus Ægineta, and Demetrius Paleologus, are sufficiently detailed in our introductory chapter, and need not be repeated. And so with regard to many of the opinions held by the Arabians and others up to the latter half of the present century; as of Avicenna, Rhases, Serapion, Hoffman, Coste, &c.

In the latter half of the last century, Cullen became the great opponent of the ancient humoral doctrine of gout, and, in his work on the "Practice of Medicine," brings forward many arguments which (at the time they were propounded) were of themselves powerful, and made still more so from the weight of his opinion : the substance of these arguments, which are of equal force with those of the present anti-humoralists, may be thus summed up:—In the first place, he urges that there is no evidence of any morbid matter being present in persons disposed to gout, and that there are no experiments or observations which show that the blood or secretions of gouty persons are in any way different from those of other persons ; that previous to attacks of gout there are no signs of any morbid state of the fluids, and the disease generally attacks those persons who enjoy the most perfect health and who even appear to be in that state when the disease comes on. Cullen allows, however, that at certain periods of the disorder, a peculiar matter appears in gouty patients, but that this occurs only in a few instances, and then only after the disease has subsisted a long time, and he looks upon such an occurrence as the effect and not the cause of the malady. Furthermore, although he says that there are certain acrid substances which seem to excite gout when taken into the body, yet he considers that they do not operate by affording the material cause of it, but in some other inexplicable manner.

From these considerations, Cullen concludes that there is no proof of any morbid matter being the cause of gout.

In the second place, he looks upon the suppositions concerning the particular nature of the morbid matter as too vague and contradictory, and many of them so inconsistent with chemical philosophy and the laws of the animal economy, to allow us to conclude that any such principle exists.

Thirdly, he considers that the supposition of a morbid matter being the cause of gout is not consistent with the phenomena of the disease, particularly with its frequent and sudden translations from one part to another.

Fourthly, he regards the supposition as the more improbable from the circumstance, that if any morbid matter does exist, its operation should be similar in the several parts which it attacks; whereas it seems to be very different, being stimulant and exciting inflammation in the joints, but sedative and destroying tone in the stomach: which, upon the supposition of a particular matter acting in both cases, is not to be explained by any difference in the part affected.

Fifthly, he looks upon the disease being non-contagious, as favouring the idea of its not being connected with the presence of a peculiar matter in the system. In explanation of this remark, it must be remembered that, prior to Cullen's time, there were many who looked upon gout as contagious, and instances supposed to favour such views are to be found in many old authors, as Boerhaave, Van Swieten, and others.

Sixthly, he thinks that the fact of the disease being hereditary is no proof of its humoral origin, for he argues that most hereditary diseases do not depend upon the presence of any morbid matter, but upon a particular conformation of the structure of the body, transmitted from the parent to the offspring; and this applies he says particularly to gout. He also asserts that hereditary diseases depending on a morbid poison, always appear earlier in life than is usual with gout.

Seventhly, he states that the humoral view of the disease has hitherto not suggested any successful method of cure, but in fact has sometimes led to injurious treatment.

Eighthly, he looks upon the idea of the presence of a morbid matter as altogether useless, that it explains nothing, without supposing that it produces a change in the moving powers; and a change in the state of the moving powers explains every circumstance without the supposition of morbific matter.

Lastly, Cullen considers the view superfluous, thinking that without such supposition the disease can be explained in a manner more consistent with its phenomena, with the laws of the animal economy, and with the method of cure which experience has appointed. After having urged these numerous objections against the humoral pathologists, most of which can be shown to be devoid of weight at the present time, and many absolutely erroneous, Cullen proceeds to enumerate his own view of the nature of gout, a view which, in a somewhat modified form, has up to the present time found numerous supporters. Arguing from the statements, that males are especially affected with gout, and that those of the opposite sex who suffer from it are usually robust and of full habit, that eunuchs are seldom afflicted with it, and that the disease attacks robust men with large heads, he arrives at the conclusion that gout depends on a peculiar conformation, and more especially an affection of the nervous system, in which he thinks the primary moving powers of the whole system are lodged. He looks upon the exciting causes of the disease as intemperance, indigestion, depressing influences and cold, as acting directly upon the nervous system, and considers most of the symptoms of retrocedent gout, to be afterwards described, as manifestly affections of the same system; and, therefore, is inclined to seek for an explanation of the disease in the laws of the nervous system. He also considers the stomach, an organ so universally sympathising with the rest of the system, as most frequently and most considerably implicated in gout. This opinion he deduces from the fact that symptoms of dyspepsia generally precede an attack, and many of the exciting causes of a paroxysm act first upon the stomach, and in retrocedent forms of the disease this organ is commonly affected. He also thinks a balance exists between the state of the internal and external parts, and that the condition of the stomach is intimately connected with the latter, so that the state of tone in the one may be communicated to the other.

From these premises, Cullen forms his views of the pathology of gout, which is thus expressed in his own words:—

"In some persons there is a certain vigorous and plethoric state of the system which, at a certain period of life, is liable to a loss of tone in the extremities. This is in some measure communicated to the whole system, but appears more especially in the functions of the stomach. When this loss of tone occurs, while the energy of the brain still retains its vigour, the *vis medicatrix naturæ* is excited to restore the tone of the parts: and accomplishes it by exciting an inflammatory affection in some parts of the extremities. When this has subsisted for some days, the tone of the extremities and of the whole system is restored, and the patient returns to his ordinary state of health.

"This is the course of things in the ordinary form of the disease, which we name the *regular gout;* but there are circumstances of the body, in which this course is interrupted or varied. Thus, when the atony has taken place, if the reaction do not succeed, the atony continues in the stomach, or perhaps in other internal parts, and produces that state which we have, for reasons now obvious, named *atonic gout.*

"A second case of variation in the course of the gout is, when, to the atony, the reaction and inflammation have to a certain degree succeeded, but, from causes either internal or external, the tone of the extremities and perhaps of the whole system, is weakened; so that the inflammatory state, before it had either proceeded to the degree, or continued for the time, requisite for restoring the tone of the system, suddenly and entirely ceases. Hence the stomach, and other internal parts, relapse into the state of atony; and perhaps have this increased by the atony communicated from the extremities: all which appears in what we have termed *retrocedent* gout.

"A third case of variation from the ordinary course of gout is, when to the atony usually preceding, an inflammatory reaction fully succeeds, but its usual determination to the joints by some circumstances prevented; and is, therefore, directed to an internal part, where it produces an inflammatory affection, and that state of things which we have named the *misplaced* gout."

Most of the dogmas enunciated by Cullen are capable of being entirely disproved at the present day, for a morbid matter can be shown to be *constantly* present in all cases of true gout, not only during the inflammatory action, but even before the occurrence of the attack, and consequently the first statement of Cullen is completely erroneous. Again, the very nature of the morbid matter can now be accurately defined, and its composition clearly demonstrated. The objection that the phenomena of the disease are not consistent with the supposition of their being caused by the presence of a morbid matter, has likewise little weight, for we know that particular poisons select particular portions of the economy upon which to exert their force. Atropine for example peculiarly affects the pupil of the eye, as well as the mouth, throat and skin. Strychnia acts upon the spinal cord; the poisons of various eruptive fevers also make particular selections, that of scarlatina implicating the throat, skin, and kidneys, that of rubeola the skin and mucous membranes; and as far as the shifting of the inflammation is concerned, it is generally found to occur in symmetrical order: the argument that in one part, as in a joint, gout acts as a stimulant, in another, as the stomach, as a sedative, will now-a-days have little or no weight with any one conversant with physiology and pathology, for inflammatory action is usually accompanied with diminution or destruction of the proper functions of the organ.

The fact of gout not being contagious would not at present be considered any proof that the phenomena it displays are not produced by some morbid element in the blood, and therefore the fifth objection of Cullen falls to the ground; and the sixth, founded on the assumption that most hereditary diseases depend on a particular conformation of the structure of the body, cannot have much weight, for we know that many hereditary affections are most indubitably produced by the presence of a specific poison in the economy.

The three remaining objections need scarcely occupy our attention; the fact of a humoral view of the pathology of gout not having led to an improvement in its treatment, might with equal justice be urged against the views of the solidists; and most pathologists of the present day must feel the want of some more satisfactory explanation of the phenomena of the disease than afforded by Cullen or any of his followers.

In 1793, a small work was published by Mr. Murray Forbes, entitled "A Treatise upon Gravel and Gout," which is remarkable in containing views on the chemical pathology of these diseases, not very unlike those entertained by some modern pathologists. Mr. Forbes, for example, asserts that lithic (uric) acid, as it exists in the urine, must be present in the blood, although he confesses his inability to discover it. His words are, "its frequent deposition in different parts of the body affords indisputable testimony of its being contained in the general fluids;" and as this deposition occurs in certain circumstances, and more especially in gout, he makes the enquiry whether that disease may not arise in consequence of the concreting matter being redundant, or whether the coincidence is merely accidental. Mr. Forbes goes on to show the connection between gout and gravel, as exhibited in the similarity of the constitutions in which they occur, and the causes and remedies best suited for the two diseases, comparing the depositions in the tendinous and other structures to the formation and separation of gravel from the urine. It should be borne in mind that this view was entertained before the discovery of the real composition of gouty deposits, by Dr. Wollaston, in 1797, which accounts for the error in assuming that they contained free uric acid and not urate of soda, and of the precipitation or deposition being ascribed to the liberation of the uric acid by the aid of another acid introduced in some way into the economy. This theory, although somewhat erroneous, approaches closely to that which we shall prove to be the truth, and, considering the time it was promulgated, is characterised by great perspicuity, and was the first to give importance to the humoral doctrine of the disease.

Notwithstanding the power of the arguments brought forward by Murray Forbes, and the increased weight given to them by the subsequent discovery of Wollaston, the doctrines of Cullen continued to hold sway, at least in a modified form; and the late Sir C. Scudamore, up to the time of the publication of the second edition of the Appendix to his work on Gout, was inclined to favour the view which attributes the disease to a species of plethora, rather than to any alteration in the circulation of the fluids, as will be seen from the following passage. "In a first fit of gout, the plethoric state of the vessels, either absolute or relative, appears the predominant and often only circumstance which can be detected in the errors of the constitution. The local inflammation, usually attacking the ball of the great toe, appears to be an effort of nature to relieve the fulness of habit, partly in the way of afflux of blood to the extremity, and partly in the way of counter-irritation. In the returns of the disease, more or less of irregularity in the functions of the abdominal viscera becomes conspicuous; and it gradually assumes a more complicated character. In a general statement of the facts, it may be said that the plethora which exists is of a partial kind. That determination of blood to the extremities, which, in its peculiar actions, exhibits the phenomena of gout, becomes more and more obviously connected with congestion in the whole system of the vena portæ; with a vitiated secretion of bile, costive bowels, and unequal function of the kidneys. The stomach is truly the medium through which the gout is created. Excess of ingesta beyond the powers of healthy assimilation and the supply of blood demanded for the useful purposes of the body, is the material foundation of the disease." Further on, his ideas of the close connection between gout and a morbid state of the liver are thus expressed. "I consider that the gout which appears to the eye as an external disease, is most essentially depending on that species of repletion which belongs to the vessels of the abdominal viscera, and chiefly of the liver. In its progress it manifests this connection most strongly; and I do affirm that in every long-established case of gout the functions of the liver are more or less unhealthy, in combination with a disordered condition of the intestinal canal, with evidences of error in the secretions derived from the kidneys and from the skin; and also in proportion as the disease becomes established, the nervous system partakes largely in the derangement. The stomach itself, which at the earliest periods of gout is often little or not at all affected, now becomes disordered, and serious indigestion commonly prevails."

Still Sir C. Scudamore confessed to many difficulties in explaining the various phenomena of gout on such an hypothesis, and more especially the occurrence of chalk-stones, which he allowed were never seen except in cases of true gout; at the same time he thought them so rare, that they could not be assumed as a basis for the construction of a general theory of the disease, and much less could the matters composing them be looked upon as its proximate cause. As regards this rarity he remarked he had only found them forty-five times in five hundred cases of gout, and in several of these many years had elapsed before any trace of such concretions manifested themselves. The same author thought it could not happen that so large a proportion of persons should pass through life under the martyrdom of the disease, remaining wholly free from all evidence of the concretions, if any essential relation existed between uric acid and gout. He likewise considered that we had no proof of the existence of uric acid in the system independent of secretion, and that even if it were present, there is no apparent cause why it should not always be secreted by the kidneys,—glands obviously designed to separate saline matters. Sir C. Scudamore was of opinion that in the cases where it was thrown on the secreting vessels of the joints or other distant parts, the capillary vessels of the structures affected with gouty inflammation acted, in a greater or less degree, vicariously to the secreting vessels of the kidneys: he also states that in several cases of extensive deposits in the hands and feet, he had by repeated experiments found a deficiency and sometimes almost total absence of uric acid in the urine.

At the time this opinion was promulgated there was no proof of the production of uric acid in the system independent of secretion, and the *constant* presence of urate deposits in the structures affected with gouty inflammation was likewise unknown. Having attended Sir Charles professionally in the latter years of his life, I have reason to know that his opinion on the proximate cause of gout became much altered, and he was inclined to look upon the disease as intimately connected with the abnormal presence of uric acid in the system.

Dr. Barlow, in his article in the Cyclopædia of Practical Medicine, also supports the view of gout being closely connected with vascular plethora, and states that a paroxysm of gout can be regarded only as a constitutional disturbance of an inflammatory character, attended with local inflammation of a peculiar kind in one or more joints, running a determinate course, and in the earlier occasions terminating in health, for the most part within a few days. Recently, however, in his Manual of Practical Medicine, the author appears to have considerably altered his opinions on the pathology of gout, and now inclines to a modified humoral doctrine.

Dr. Gairdner, a few years since, advanced an hypothesis in some respects resembling those above enumerated; he believes that a general state of vascular plethora of the great chylopoietic organs is always met with in gout, as also the constant presence of a varicose state of veins of the lower extremities during an impending fit; that the heart is oppressed with a flood of returning venous blood, associated with an impure condition of this fluid from the non-elimination of urea and urates, and probably of biliary constituents which cause the symptoms of disordered function of this organ. He however advances a step further than the authors before quoted, and thus describes his idea of the pathology of the gouty seizure:

"Venous congestion I consider the first condition essential to the formation of the gouty diathesis. It is no new observation; it is found interspersed through the writings of all former authors. Even those who adopt explanations inconsistent with such a state of things, notwithstanding admit it. This state of the blood was first clearly enounced as the great cause of gout by Galen, whose opinions have continued to influence the minds of succeeding physicians in a greater or less degree, to the present day. The truth of the fact being, I imagine, unquestionable, it will always continue to embarrass the doctrines of those who advocate opinions with which it is incompatible. But the great venous canals of the body, as well as the larger arterial vessels, are endowed with a resiliency, which enables them to struggle well against the flood of returning blood. This fluid, then, is compressed between two opposing forces, that, namely, which is derived from the heart and arterial system, urging it forward on its course; and, on the other hand, the antagonistic resistance of the great veins leading to the right auricle. Under this compression I believe that the vessels give way, and a true hemorrhage is occasioned in the part affected. If the rupture takes place in a minute capillary carrying the serous portion of the blood only, edema is the consequence; but if the burst vessel be one carrying red blood, a true ecchymosis is formed."

And again: "It will surely be admitted that the capillary and nutrient vessels, distributed on the extreme and sentient fibrillæ of the nerves, are affected in the same manner as the larger venous trunks. I believe these distended capillary vessels are the real seat and cause of the painful phenomena of gout. Is it not credible that such vessels, dilated so as to admit fluids for which they were not intended, and bound down by the firm fasciæ, in which gout has its usual seat, may give rise to much suffering?"

It will be a no more difficult task to refute these views of the nature of gout than the one advanced by Cullen. Let us take for example Dr. Gairdner's hypothesis, which is the most comprehensive of the three and includes the rest, and examine it in detail. First, with regard to the general state of vascular plethora of the great chylopoietic organs which he says is always met with: I believe that in gout, especially where it occurs in patients apparently robust, and more particularly if acquired, a state of plethora of the abdominal organs is generally present before the attack, and there is then a fulness of the right hypochondrium and epigastrium, sluggish bowels, defective excretion of bile, dyspepsia, and other symptoms usually attending such a state of habit; but that these are constant I much question, and could bring forward records of numerous cases in which there was no evidence of any such congestion of the organs connected with the portal system of veins, and such absence is more commonly seen in spare subjects and in those who strongly inherit the disease, and in whom we shall find as we proceed further in our investigations the kidneys rather than the liver are defective in their action.

On the other hand, if congestion of the digestive organs be intimately connected, and even a necessary antecedent of the gouty paroxysm, how does it happen that in certain diseases in which these organs become loaded with blood, and in which congestion is so prominent a symptom, the sufferers are not more frequently afflicted with visitations of gout? Seeing that, according to Dr. Gàirdner, they have all the necessary elements for the production of the hemorrhage of the minute vessels of the extremities, and which often become strikingly evident in the occurrence of varicose veins and edema. Moreover, almost all serious diseases of the heart, when that organ has become so defective in its action as to allow of congestion of the whole venous system, should, according to the above view, be followed by a paroxysm of gout. That this is seldom the case, all medical experience will confirm.

The veins leading from the inflamed part certainly become turgid at the time of the fit, and so constantly is this the case that turgidity is one of the peculiar characteristics of gouty inflammation; but I should doubt its occurrence during an impending attack, and believe it to be the effect of some prior mischief within the joint. We frequently find a person retiring to rest in apparent health, with no stiffness and no trace of swelling or enlarged veins, the first symptom felt being the acute pain, followed, it is true, at short intervals, by the appearance of turgid veins, and other signs of inflammatory action.

Next, as to the occurrence of hemorrhage in every fit of gout, which is regarded by Dr. Gairdner as the cause of the local affection, and which, he thinks, will probably startle his readers by its novelty: Dr. Gairdner believes that hemorrhage will explain all the phenomena of gouty inflammation, and that it is the true *rationale.* Against this view it may be urged, in the first place, that as the author brings forward no proof of the occurrence of hemorrhage in any gouty fit, he has never seen the true ecchymosis alluded to; and with regard to the colourless hemorrhage or serous exudation, this occurs in numerous affections besides gout, and can be readily accounted for without assuming the very questionable existence of vasa serosa.

As the reader will perceive, by referring to the chapters on morbid anatomy, and the Appendix, my available opportunities of examining parts affected with gout have been numerous, but I must confess never to have seen the slightest proof of Dr. Gairdner's assertion; on the contrary, other appearances have invariably been observed which are completely pathognomonic of gouty inflammation.

If space permitted I might enter into the consideration of the opinions of many other physicians who have within the last century written upon gout, but it will suffice to do little more than enumerate the names of some of these authors. In this country Drs. Parkinson, Wollaston, and Sir E. Home, have advocated the doctrine of the humoral pathologists, and considered that a close relation exists between gout and the presence of uric acid in the blood. Others, however, as Drs. Parry and Sutton, looked upon the disease as either dependent on some peculiarity of the circulating system, or as intimately connected with disorder of the digestive organs.

On the Continent, especially in France, the views of the pathology of gout held by the most eminent writers, as Barthez and Guilbert, have been extremely vague; the former scarcely venturing upon any hypothesis, but contenting himself with regarding gout as dependent on a peculiar disposition of the system, combined with weakness of the affected parts: the latter, explaining the phenomena by the supposition that under the influence of certain causes which impair the functions of digestion, impede the action of the skin, and give rise to a condition of plethora, a matter intended to be excreted is retained, and the lymphatic system thus becomes loaded with this the *materies morbi.*

Other French physicians, as Cruveilhier and Dr. C. Petit, look upon gout as intimately connected with the presence of uric acid in the system, and both authors, who wrote prior to the actual proof of its existence in the blood, employ powerful arguments in support of their opinions.

Before offering to the profession my own views upon the nature of this disease, I cannot refrain from alluding to the conclusions arrived at by a physician who appears to have taken a deep and comprehensive survey of all the data which had been established at the time his article was penned. I allude to Sir Henry Holland, who in his Medical Notes and Reflections devotes a chapter to the subject, and considers that the greater part of that which is either ascertained or strongly presumed with regard to gout, may be comprised under the following general heads.*

1. That there is some part of the bodily organisation disposing to gout, because it is an hereditary disorder.

2. That there is a *materies morbi,* whatever its

---

* This chapter was written many years before the discovery of uric acid in the blood.

nature, capable of accumulation in the system—of change of place within the body—and of removal from it.

3. That though identity be not hitherto proved, there is a presumable relation between lithic (uric) acid, or its compounds, and the matter of gout, and a connexion of this with other forms of the calculous diathesis.

4. That the accumulation of this matter of the disease may be presumed to be in the blood, and its retrocession or change of place, when occurring, to be effected through the same medium.

5. That an attack of gout, properly so called, consists in, or tends to produce, the removal of this matter from the circulation, either by deposits into the parts affected, by the excretions, or in some other less obvious way, through the train of actions forming the paroxysms of the disorder.

6. That there is an intimate relation between the condition of the gouty habit, and the functions of the kidneys and liver, both in health and disease.

7. And that the same state of habit or predisposition, which in some persons produces the acute attack of gout, or slower deposits about the joints, does in others, particularly in females, testify itself solely by disorder of internal parts, including the nervous system, as well as various secreting and excreting organs of the body.

How far these reflections agree with that which I shall now endeavour to establish as the pathology of gout, I shall leave to the decision of my readers.

Having brought under notice the different ideas of the proximate cause or nature of gout, which have been held both in ancient and modern times by physicians whose opinions are most worthy of esteem, and having had occasion to point out the fallacies of many of them, it behoves me now to expound the views which I have myself arrived at, from a long and attentive consideration of the varied phenomena of the disease, and this task I will endeavour to perform in as succinct a manner as possible.

In the Medico-Chirurgical Transactions for 1848, I ventured to advance the following guarded opinion, derived from several observations on the condition of the blood and urine in gout, rheumatism, and albuminuria. "The results of these experiments on the condition of the blood and urine, prove that uric acid is not a product of the action of the kidneys, as frequently supposed, but that it is merely excreted from the system by these organs. They also appear to indicate that the excreting function of the kidneys with regard to the solid portion of the urine, is not simple, but that urea and uric acid are separately eliminated; also that one of these functions may be impaired or destroyed, the other remaining entire. It appears also probable that, as in albuminuria, the *urea-excreting* function being chiefly impaired, we find a vicarious discharge of this body in dropsical effusions; so, in gout, the *uric acid-excreting* function being defective, chalk-like deposits are produced, by a similar vicarious discharge of urate of soda.

"Gout would thus appear partly to depend on a loss of power (temporary or permanent) of the uric acid-excreting function of the kidneys; the premonitory symptoms, and those also which constitute the paroxysm, arising from an excess of this acid in the blood, and from the effort to expel the *materies morbi* from the system. Any undue formation of this compound would favour the occurrence of the disease; and hence the connection between gout and uric acid gravel and calculi; and also the influence of high living, wine, porter, want of exercise, &c., in inducing it.

"This hypothesis also explains two facts, which have been regarded as militating against its humoral pathology, namely, the hereditary nature of the affection, and also its frequent occurrence in low states of the system; for we can understand that the peculiarity of the kidney, with reference to the excretion of uric acid, may be transmitted; and, likewise, that when the function in question is permanently injured, it will not require an excessive formation of this acid to cause its accumulation in the blood."

These views were made public more than eleven years since, and subsequent clinical observations have fully confirmed their accuracy; although by themselves insufficient to explain all the phenomena of gout, still, by their aid in conjunction with other more recent investigations, we shall be able to give a rational exposition of the disease.

First, in true gout, uric acid is invariably present in the blood in abnormal quantities, in the form of urate of soda, both prior to and at the period of the seizure, and is essential to its production; but it can be equally proved that this acid may occasionally exist largely in the circulating fluid without the development of inflammatory symptoms, as, for example, in cases of lead poisoning, and a few other instances. Its mere presence, therefore, does not explain the occurrence of the gouty paroxysm.

Secondly, the investigations recently made in the morbid anatomy of gout, prove incontestably that true gouty inflammation is *always* accompanied with a deposition of urate of soda in the inflamed part.

Thirdly, the deposit is crystalline and interstitial, and when once the cartilages and ligamentous structures become infiltrated, such deposition remains for a lengthened time, perhaps during life.

Fourthly, the deposited urate of soda may be looked upon as the cause, and not the effect, of the gouty inflammation.

Fifthly, the inflammation of gout tends to the destruction of the urate of soda in the blood of the part, and consequently of the system generally.

Sixthly, the kidneys are implicated in gout, probably in its early and certainly in its chronic forms, and this affection is not only functional but subsequently becomes structural; the urinary secretion is also altered in composition.

Seventhly, an impure state of the blood, arising principally from the presence of urate of soda, is the probable cause of the disturbances which not unfrequently precede the seizure, and of many of the anomalous symptoms to which gouty subjects are liable.

Eighthly, the causes which predispose to gout, independently of those connected with individual peculiarity, are either such as produce an increased formation of uric acid in the system, or which lead to its retention in the blood.

Ninthly, the causes exciting a gouty fit, are those which induce a less alkaline condition of the blood, or which greatly augment the formation of uric acid, or such as temporarily check the power of the kidneys for eliminating this principle.

With regard to the facts enumerated in the *first* of these propositions, namely that the blood in gout always contains an abnormal quantity of uric acid during the attacks, sufficient evidence has been already afforded, inasmuch as it has been shown in Chapter iv., that in forty-seven patients suffering from the disease of which an account is given, the blood contained much uric acid; and subsequently to the formation of the table, an examination of at least as many other patients, has demonstrated the same truth. That this impregnation occurs prior to an attack, is well illustrated in Case 5, of lead paralysis detailed in Chapter viii. where the blood was examined shortly before the toe affection made its first appearance. And that in certain instances the blood may contain an abnormal amount of uric acid without the occurrence of gouty inflammation, evidence has been afforded in some cases of lead-poisoning, and others will be alluded to in a subsequent Chapter on Rheumatic Gout. It has also been shown in Chapter iv, that in many cases of gout, other morbid matters are usually present in the blood, especially small amounts of urea and of oxalate of lime.

In the Chapters on the Morbid Anatomy of Gout, and in the supplemental portion contained in the Appendix, I believe sufficient evidence will be found to convince any pathologist of the truth of the *second* proposition; for not only has proof been afforded that a deposition of urate of soda occurs in the chronic forms of the disease, but that even the slightest amount of gouty inflammation is likewise accompanied with a similar deposit. Its presence has been discovered in a case in which only one small joint had been affected, fig. 14, as also in a knee-joint, known to have been but once inflamed, and that very slightly, fig. 25 Appendix. This fact I wish to impress forcibly on the minds of my readers, because in the constancy of such deposition, lies the clue which has long been wanting: its occurrence is perfectly pathognomonic, at once separating gout from every other disease which at first sight may appear allied to it.

To my *third* proposition, little further need be added, as I have already stated that in very numerous instances I have found the deposit within the cartilages and ligaments distinctly crystalline, and undoubtedly interstitial; and with respect to their long persistence when once deposited, I can bring forward strong evidence. In Case 9, Chapter vi, for example, where only the ball of one great toe had been implicated, two years had elapsed, still the deposit was discovered. At least, an equal time had elapsed in Case 12 Appendix, where the knee had been once only very slightly inflamed, yet distinct evidence of the mischief remained; and from what I have seen in numerous other instances, I feel assured, that when once deposition occurs in tissues of low vitality, no short period of time is required for their removal. In the majority of cases they probably remain during life, increasing more and more, at each succeeding fit of the disease.

It is of the highest importance to establish the truth of the *fourth* proposition, namely that the deposited urate of soda must be regarded rather as the cause than the effect of the gouty inflammation, inasmuch as it bears closely upon the pathology of the disease; but there are at the same time certain attendant difficulties in the inquiry. There are several reasons which militate strongly against the supposition of the deposit being the effect of the inflammation; for instance, when tissues, little liable to take on inflammatory action, become infiltrated with urate of soda, but slight vascular disturbance is produced, this is especially the case with the fibro-cartilage of the ear; and although we now and then meet with patients aware of the formation of the little nodules, who experience, in fact, a gouty fit in the ear, yet in many instances, perhaps in most, attention has never been directed to the part, so slight has been the inflammation caused by the effusion. In Plate I, where the ear sprinkled by these small nodules is delineated, several enlarged blood-vessels are observed leading from the deposited matter.

Another reason, strongly against the same supposition is the statement contained in the *fifth* proposition, to be now considered, namely, that the inflammation of gout tends to the destruction of the urate of soda in the blood of the part. The proof of this is to be seen, first, in the fact that the serum effused by the application of a blister to the inflamed part does not exhibit evidence of containing uric acid, when the blood of the patient and the blister serum from another portion not so inflamed readily shows its presence: and secondly, in the peculiar situations and manner in which these depositions occur; selecting for example structures possessed of slight vascularity, as cartilage, fibro-cartilage, ligament and tendon, and the surface of synovial membrane; and even in these tissues, keeping to such portions of them as are furthest removed from the influence of blood-vessels. Thus the deposit in articular cartilage, although completely interstitial, first takes place at the free surface, and very gradually travels inwards towards the bone. The only marked exceptions I have seen to this rule, have occurred in the patella, in which occasionally nodules of urate of soda are observed at some distance from the articulating surface, often close upon the osseous tissue; but we must remember that the patella is a sessamoid bone, and by no means vascular in its structure; this may probably account for the fact that Cruveilhier discovered deposits which he considered to consist of urate of soda, even within the patella itself.

We have likewise seen that on the surface of bones much altered by gout, especially the condyles of the femur, the deposit avoids the continuity of the vascular fringes of synovial membrane; a fact first pointed out by Dr. W. Budd, and seen in the delineation of the knee-joint, in Plate III, fig. 1.

Lastly, the results of certain physiological experiments in which uric acid has been injected into the blood, and likewise the readiness with which it is decomposed out of the system, confirm the idea that contact with blood-vessels, more especially when in a state of inflammation, has a tendency to cause the destruction of uric acid. It would thus appear that the gouty fit is, to some extent, a salutary process, ridding the system of much which may have been accumulating for a considerable time; but we must likewise remember that it is always attended with a certain amount of local mischief, which may or may not prove of subsequent inconvenience.

The truth of the *sixth* proposition has been fully demonstrated in Chapter vii, where it has been shown that, with one exception, in subjects who had in any degree suffered from gout, the kidneys were altered by the deposition of urate of soda, both at the ends of the pyramids and in the direction of the tubuli uriniferi; that in many instances these organs were contracted; and in all, save one, an appreciable change had ensued in the cortical structure. The kidneys have long since been imagined to be affected in gout; Morgagni, for example, had an idea that we should find a clue to the disease in the condition of these parts, and many of the writers before quoted have looked upon the kidneys as implicated in conjunction with the other abdominal viscera.

The effect of gout in altering the renal secretion has likewise been fully detailed, the uric acid excretory function proved to be defective, and the urine itself often impregnated with a small amount of albumen. The imperfection in the eliminating powers of the kidney is sometimes the chief, if not the only cause of the impure condition of the blood, for to show that an augmented formation of uric acid in the system is not necessarily accompanied with its excess in the blood, we have only to refer to the case of birds, in which the whole of the nitrogen is eliminated in this form, and yet the blood remains pure. In proof of this I may mention, that in several instances I have examined the blood of the turkey, duck and pigeon, and have always found it quite free from any excess of uric acid.

The *seventh* proposition is difficult to prove, although almost every physician is accustomed to recognise a close relation between particular symptoms and the presence of certain morbid matters in the blood. We have absolute proof derived both from physiological and pathological observation, that when the urinary secretion is completely stopped, most serious and even fatal symptoms ensue, and it is therefore reasonable to suppose, that if one or more of its constituents be retained in the blood, certain morbid phenomena would result therefrom. Some of these symptoms in the case of gout may arise simply from the presence of the special impurity, others possibly from an attempt at its deposition, and the consequent reaction. I should be inclined to regard the dyspeptic symptoms which usually precede the gouty fit as due to the former, and many of the anomalous and irregular forms of the disease which we shall hereafter more fully consider, as dependent rather upon the latter cause.

The discussion of the *eighth* proposition is of much interest and considerable importance, for if we can prove the truth of the statement that the predisposing causes are of different kinds, one leading to the increased formation of the morbid matter, the other to its retention in the blood, we at once have a clue to the varieties of the disease, popularly known, one as the rich, the other as the poor man's gout. As it has been shown that the inflammation is invariably accompanied by the deposition of urate of soda, which may be regarded as its cause, it is evident that any circumstance tending to an accumulation of this salt in the system, and thereby paving the way for its infiltration into the articular tissues, becomes a predisposing cause; whether this arises from its augmented formation and the consequent overtaxing of the renal organs, or whether the excreting power of the kidneys be simply impeded in their normal function. It appears probable, that in the majority of cases of gout, both causes are in operation; but on the other hand it is easy to conceive that either, if active, might lead to the production of the disease. In the former case the affection would be typical of the rich man's gout, in the latter, of the poor man's.

In the *ninth* proposition we have assumed that infiltration of urate of soda into the tissues may take place in two ways, either by its great accumulation in the blood, or by that fluid being rendered less capable of holding it in solution; the former condition may be caused by a temporary increase in its formation, as by aggravated dyspepsia, brought on by partaking of very indigestible articles of diet; or by a sudden loss of the uric acid-excreting power of the kidneys induced by mental shocks, severe accidents, and so forth, all of which we know to be very potent in exciting a fit of gout; the latter condition is more likely to be induced by partaking of acid liquors, as particular kinds of wine, hard beer, pickles and acids, or by the suppressed action of the skin causing defective elimination of the acid which is naturally thus thrown off, and hence a diminution in the alkalinity of the blood.

The serum, in which the urate of soda is dissolved, is alkaline, and this reaction is caused in part by phosphate of soda, in part by alkaline bicarbonates. In no case of disease, and my opportunities have been very numerous, have I found this fluid acid, and it is probable that such a state would be incompatible with life; but there is often a marked alteration in the amount of its alkalinity, and in many cases of chronic gout, it has shown great approach to neutrality. Any diminution in the alkaline state of the blood lessens its power of holding urate of soda in solution, and hence promotes its deposition, especially in tissues in which the reaction is naturally less alkaline than in blood. To illustrate this experimentally, we may take a watery solution of the common phosphate of soda, and dissolve uric acid in it, but only to such an extent as to ensure the fluid remaining alkaline. Any diminution of this reaction by the subsequent addition of a weak acid, will cause the precipitation of urate of soda; but if the fluid is rendered acid, crystallisation of free uric acid will ensue. On this view we are enabled to explain differences in the class of exciting causes before alluded to; namely, that some of them are of the same nature as those which predispose to gout, but that others, however long their action is continued, are powerless as predisposing causes. We now see the reason of this difference: those agencies which when in active operation lead to a rapidly augmented formation of uric acid and the production of a fit, must necessarily, if in slower action, predispose to the affection; whereas agencies which simply diminish the alkalinity of the serum, and render the urate less soluble, cannot of themselves in any way produce the disease; thus cold which so often excites a fit of gout, never induces a gouty habit.

Having enumerated and considered these propositions, we will next endeavour, by their aid, to explain certain peculiarities which are met with in the progress of gout, many of which have proved of great difficulty to pathologists; and first, with regard to the phenomena of the fit. It is essential for its production that there should be an impure condition of the blood from the presence of urate of soda, and such impurity may be induced by the action of any of the various predisposing causes of the disease, and is probably of itself sufficient to give rise to the premonitory symptoms which are chiefly manifested in functional derangement of the digestive and circulating organs. To excite a gouty paroxysm, however, requires the additional operation of other agents; namely those causes by which the urate of soda is either suddenly augmented or rendered less soluble, and its crystallisation consequently induced in the ligamentous and cartilaginous structures of the joints. The intensity of the pain which usually accompanies a gouty fit depends upon the rigidity of the parts, or of the state of tension within the joint, for it is only when the inflammation is inter-articular, that it is so peculiarly intense; when confined to the more superficial structures around the joints, the pain in gout has not appeared to me to be more severe than that which occurs in many other diseases.

A peculiarity of gouty inflammation, described in our second chapter, is the occurrence of edema, and the subsequent desquamation of the cuticle; these symptoms are of some importance, as they are so frequent in gouty, so rare in rheumatic inflammation. An explanation has been before hinted at, namely that the edema depends on urea in the blood, and we have seen that this principle is frequently present in gout, and likewise know that in cases of albuminuria, where the elimination of urea is greatly impeded, edema becomes a prominent symptom; and in scarlatina, where the kidneys are so liable to be affected by the poison, desquamation of the skin is a characteristic attendant. I cannot help thinking that the above may be the true explanation; but in order to prove it beyond doubt, certain clinical and chemical observations are required which have not yet been satisfactorily made. The occurrence of chalk-stones, or gouty tophi, which has so long been a stumbling-block to those who denied the existence of an altered blood, is now easily explained; every paroxysm of gout is attended with a deposit.

Sir Henry Holland remarks that a difficulty in the history of gout, and one not easily reconcilable with the view of the disease being dependent on a *materies morbi,* is the fact of the frequent attack of some joint with gouty pain and swelling, without any well marked symptoms to give warning of its approach; for it is necessary to explain how the matter, capable by accumulation of producing an attack, should have been dormant up to the time of the seizure, and why, latent thus long, it should suddenly show itself in an acute form of disease. These questions he confesses could not be answered on the existing knowledge at the time he wrote.

According to our view their solution is a very easy task, for we have shown that the mere accumulation of the urate is quite unequal to the production of inflammation, and that its actual deposition in tissue is essential, an occurrence which usually requires a peculiar exciting cause; and hence in many cases there may be no well marked symptoms to give warning of the approach of a fit, and hence also the poison may lie dormant for a considerable time; but when crystallisation of the salt takes place in any tissue, inflammation is suddenly lit up by its presence, and a paroxysm of gout ensues.

Questions in the history of gout of much greater difficulty to solve, are the following:—

Why does gouty inflammation in its earlier attacks peculiarly select the ball of the great toe? And why, in old standing cases, are the affected joints usually more numerous than in early attacks?

To answer the first of these questions has been the attempt of many physicians; Sydenham says "the feet are the genuine seat of the peccant matter, which may without doubt fix itself on other parts; but in that case it is plain that either the progress of the distemper is inverted, or the patient's strength, from repeated attacks, is gradually impaired."

Boerhaave has an aphorism to this effect, that the part which gout first and regularly attacks is always the foot, and chiefly those tissues which the liquids have most difficulty in passing through, as the periosteum, tendons, nerves, membranes, and ligaments, and such as are most remote from the heart, and most pressed upon and injured. His commentator, Van Swieten, adds that, considering the difficulty with which the liquids pass through these parts, no improbable notion may be formed why gout is generally observed to commence in them, as they suffer great pressure from having to sustain the weight of the whole body, and being far removed from the heart are subjected to the action of cold and moisture; and the blood brought to them through the arteries, when returning through the veins, has the force of gravitation to overcome. The feet are also peculiarly liable to be hurt in walking, leaping, sudden falls, and accidents.

I believe there is much truth in these remarks of Boerhaave and Van Swieten, although the state of pathology at that period would not allow these authors to advance further in explanation of the subject.

There are many circumstances causing the great toe to be selected for the first deposition of the gouty matter; it contains, for example, in abundance, the tissues particularly prone to be affected, namely, tissues either of little vascularity, or nourished altogether independent of blood-vessels; it is likewise very remote from the heart, and where the power of the circulation is at its minimum; in addition to this, the metatarso-phalangeal joint is one which is subject to pressure and injury from having to support the weight of the body.

In connection with the subject I may mention that in the examination of this joint in many individuals who have never experienced any symptoms of gout, I have very commonly found distinct evidence of injury on the surface of the cartilage, both of the head of the metatarsal bone and of the cup-like cavity of the phalanx, when these appearances were not present either in the corresponding joints of the other toes, or in any of the phalangeal articulations.

Lastly, we know that certain poisons are, as it were, attracted to particular parts, and the external phenomena displayed by their action are usually symmetrical in form; this is exemplified in many cutaneous affections, as those dependent on a syphilitic taint of the system. The same is shown by the selection which many powerful remedies make of the organs upon which to exert their energy: thus digitalis acts on the heart, opium on the cerebrum, and strychnia on the spinal cord.

As regards the second question, why numerous joints are implicated in advanced gout, the following appears to be the probable explanation. When the disease becomes engrafted into the system, the amount of urate of soda in the blood is necessarily augmented, and requires more surfaces upon which to deposit itself, and hence other joints in addition to the great toe are selected; and moreover, the cartilages and ligaments of the joints first attacked, after a time become completely incrusted, so much so indeed that the ball of the great toe is in many cases completely anchylosed, and converted into an almost solid case of urate of soda, and no further deposit can take place.

It is interesting to observe the regularity in which, under ordinary circumstances, the joints become implicated. First the great toe, then the heel and ankle, afterwards the knee, the smaller articulations of the hands, the elbows, and lastly the shoulders and hips. There are it is true many exceptions to such a sequence, but these can usually be accounted for by the occurrence of blows, sprains, or other injuries. It will be observed that the order has considerable relation to the conditions we have alluded to, as tending to the deposition of the urate of soda; for example, the heel and ankles are much exposed to pressure, and are also remote from the central organ of the circulation; the knee is likewise under somewhat similar circumstances. The hips and shoulders are the least frequently affected, as will be seen in the details of the examinations in the chapters on Morbid Anatomy, and these are the joints in which the circulation is most active, being near the large arterial trunks, and the obstacles to the return of venous blood from them being slight; they are also protected by thick coverings of muscular tissue. When deposits are formed in the more external parts of the body, those are commonly selected in which the circulation is sluggish; thus we have found the helix of the ear to be a favourite point, and probably this organ is colder than any other portion of the frame. I have before mentioned that in my experience, when patients have had chalk-stones about the joints and not in the ears, these parts were warmer than usual: I do not remember ever having seen them in the ears of women. May not this arise from their being generally kept warm by some covering?

The next point which naturally arises in the course of our inquiry is, the reason why deposits of urate of soda so constantly take place in ligaments and cartilages, or closely allied tissues. One reason is that these structures possess but little vascularity, and the deposit is at once placed beyond the further influence of the blood-vessels; but besides this it is probable that the fluids of these tissues are less alkaline than those of many others, and certainly less alkaline than the blood itself. Sometimes, in old gouty cases, only a few hours after death, the re-action of the synovial fluid in the joints becomes distinctly acid; but I have proof that this is by no means constant, as will be seen in the accounts of several of the dissections before detailed. These two circumstances, then, namely, the slight vascularity of the tissues and the less alkaline state of the fluids, may probably explain the reason why such parts are much more frequently attacked than any others.

Why are females comparatively exempt from gout, at least in its more regular manifestations, and why does the disease so seldom attack young people? These questions can be readily answered. Women, although liable to the influence of hereditary predisposition, are to a great extent free from the action of many of those extraneous causes which both induce and excite gout, more especially excesses in wine and malt liquors; in addition to which they partly owe their immunity to the occurrence of the catamenial discharge during many years of adult life, which constantly tends to rid the system of superfluous blood without engendering debility. It is after the cessation of this function, or when it has become arrested by accidental causes, that gout is most apt to develop itself in women, and the aphorism of Hippocrates already referred to is practically correct. During youth, when the growth of the body is rapidly advancing, and excess of nourishment is required to build up the frame, and the secreting functions are in full activity, there is little tendency to engender such a state of blood as would lead to the development of gout, and youth moreover is seldom subject to many of its predisposing causes.

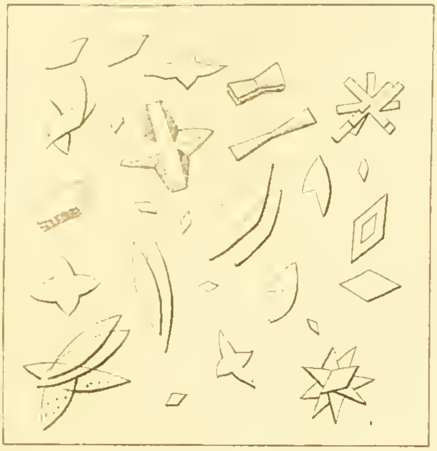
It would thus appear that hereditary predisposition alone is unequal to cause development of gout, and there are many examples on record of men so circumstanced passing through life without an attack of the disorder; but in them, as well as in women, it is common to find strong evidence of their constitutional peculiarity in the manifestation of many symptoms of the masked or irregular forms of the disease, and the same is occasionally witnessed in young people.

Lastly, it may be asked why does gout almost invariably recur, and why in its returns does it at first exhibit signs of periodicity?

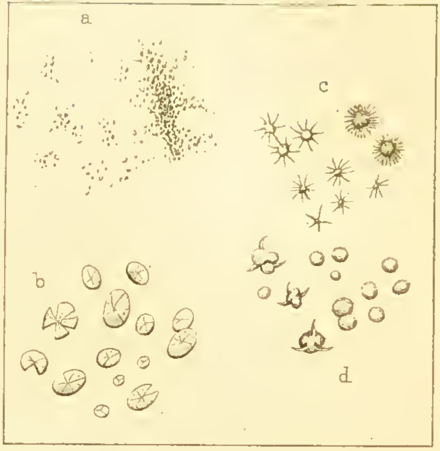
These phenomena are explained by the fact, that in gouty subjects an impure state of the blood is almost constantly present, arising either from an increased formation of urid acid in the system, or from its defective elimination; when, therefore, any exciting cause is more than usually active, a fit is at once induced; in the early stages this usually happens in spring or in autumn, but after a time the seizures become more frequent, and are brought on by the operation of the slightest irregularities. Now and then only a single fit occurs during life, but such cases are quite exceptional. In individuals not hereditarily predisposed to gout, great care in diet and regimen, and a completely altered course of life, will sometimes prevent a further recurrence, even after several attacks have been experienced.

Plate V.

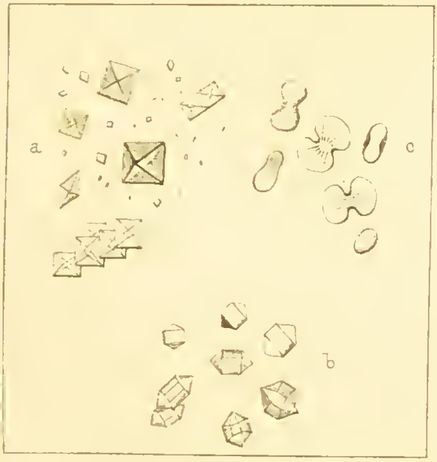
1.



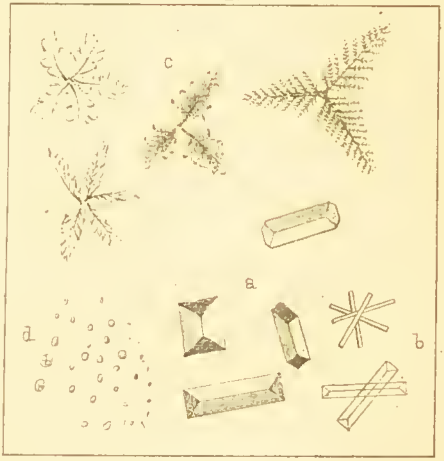
2.



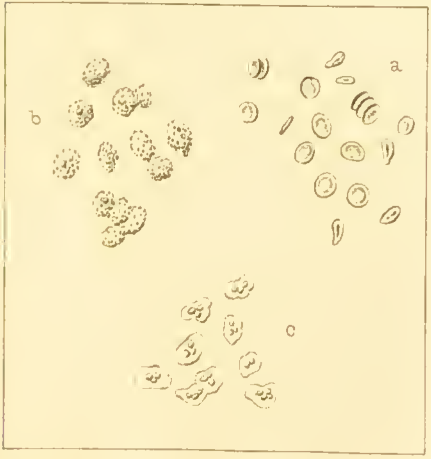
3.



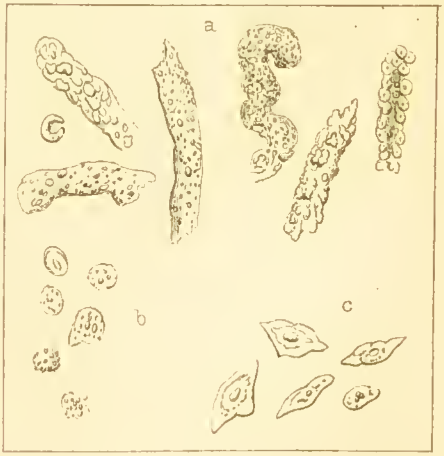
4.



5.



6.



C H Ford.
W West. imp

CHAPTER X.

TREATMENT OF GOUT:—SHORT REVIEW OF THE TREATMENT ADOPTED BY THE ANCIENTS—IS GOUT A CURABLE DISEASE?—CULLEN'S OPINION—AUTHOR'S VIEWS ON THE VALUE OF REMEDIES IN THE DIFFERENT STAGES OF GOUT—TREATMENT OF ACUTE GOUT—DIET AND REGIMEN—THE VALUE OF PURGATIVES—MERCURIALS—THEIR INJURIOUS EFFECTS IN MANY CASES—DIURETICS AND DIAPHORETICS—BLOOD-LETTING—COLCHICUM—LOCAL TREATMENT—LEECHES—BLISTERS—WARM APPLICATIONS—EVAPORATING LOTIONS—ANODYNES—SUMMARY OF THE TREATMENT OF THE GOUTY PAROXYSM.

THE general plan of treating gout adopted by the ancients has been already sufficiently indicated in our introductory chapter, from which it may be gathered that physicians of olden times had recourse to free depletion by the use of bleeding, purgatives, and emetics, often combined with the employment of the hermodactylus; at the same time enforcing abstinence in diet, especially at the commencement of the paroxysms. They also had recourse to local appliances, as scarifications, fomentations, and emollient ointments. During recovery a more generous diet and stomachics were allowed, and friction of the affected joints frequently enjoined.

Their remedial methods were founded on their ideas of the nature of the disease and the best means of getting rid of the offending matter from the system;

but the heroic plans adopted by some of them, however available at the time, would certainly ill-suit the gouty of the present generation, for whom we must now endeavour to point out the means most likely to conduce to the alleviation and cure of their sufferings.

Is it possible to cure gout? is an inquiry not unfrequently made, and the answer generally arrived at is by no means satisfactory either to patient or physician. An opinion has long prevailed, not only among the public but in the profession likewise, that gout is altogether an incurable malady; that in reality gout alone is the cure of gout; in other words, that a fit of the disorder is essential to rid the system of the impurities which have led to its production. Such an idea probably arose from the remarks contained in the writings of some of the ablest physicians upon this subject. Among others, in the works of Sydenham, who says, "in gout, it seems as if it were the prerogative of Nature to exterminate the peccant matter after her own fashion, to deposit it in the joints, and afterwards to void it by insensible perspiration;" and Cullen remarks, that the cure of the disease has been commonly thought impossible; and looking upon gout as a disorder of the whole habit, and often depending on original conformation, he considers it probable that it could not be cured by medicines, the effects of which are always transitory, and seldom extend to the production of any material change in the economy. He also considers that it would perhaps have been fortunate for gouty persons had this opinion been implicitly received by them, as it would have prevented their becoming so often the dupes of quacks, who either trifled with inert medicines or rashly employed those of a pernicious tendency.

Although individuals possessed originally of strong constitutions are now and then found who experience periodic attacks of gout, sometimes for more than half a century, without appearing to be materially injured by their occurrence, yet such cases form the exception to the general rule; which is that the disease becomes more chronic in its nature, the depositions of the urate increase both in and around the joints, producing stiffness and deformity, and often appear on the surface of the body, and the eliminating power of the kidneys becomes gradually less efficient. It is true that a patient often feels much relieved after a severe fit of gout, for the system by this means has rid itself in a great measure of impurities which were previously causing many distressing symptoms; a fact which gave rise to the opinion of Sydenham, that the more violent the inflammation the shorter the paroxysm, and the longer the interval between it and the next.

But we have likewise seen that gouty attacks, although they may in a certain degree be regarded as curative, are also destructive, and that a deposition of the morbid principle invariably occurs in the inflamed joint, which must henceforth act in some degree as foreign matter, and frequently lead to ulterior mischief. This view of the pathology of gout being established, it is only reasonable that our endeavours should be directed to prevent the formation, and aid the expulsion, of the impurities by other channels than the articular surfaces, and not to encourage the fit, as has been sometimes advised.

My own opinion with regard to the value of treatment in gout, derived now from a somewhat extensive experience, is—

First. As regards the acute fit, it is quite as controllable and as much under the influence of remedies as any other inflammatory affection; and no doubt need exist as to the most judicious and effectual plan to be pursued. I wish at the same time to lay great stress upon the character of the treatment, feeling fully convinced that, not only the duration of the fit but likewise the injury inflicted upon the joints depends much upon its judicious administration.

Secondly. The more chronic forms of gout, which are met with in every degree of severity, are likewise greatly within the power of the physician, if not for their radical cure (and this can scarcely be looked for when crippling of the joints and extensive deposits have already occurred), still for so much relief as to enable the patient again to enjoy life, and prevent further increase of mischief, so prone to ensue if the disorder be left to run its own course, and especially if recklessly tampered with.

Thirdly. As gout is a disease which is not only apt to return with increased severity, but to acquire a firmer hold on the constitution at each visitation, it is a matter of serious moment to consider whether it may not be prudent in the intervals of the attacks, not only to regulate the diet and regimen of the sufferer, but even occasionally to have recourse to some means, scarcely to be called medicinal, by which the blood is kept more free from those impurities, which by their accumulation lead to the production of the paroxysms. That this may be successfully accomplished in many instances, I have seen much evidence to prove.

The method occasionally recommended, and founded on Cullen's aphorism, of trusting to patience and flannel alone in the treatment of gout, is one which must be highly deprecated. It may indeed be argued that it is the natural mode, and that nature is a sure guide; but it must be remembered that man living in a civilised country is by no means in a normal state, or in all probability he would never have acquired the disease, and that when suffering from a disorder so acquired, he must be content to have recourse to artificial remedies. If he could entirely lay aside his usual habits, and follow in all respects the dictates of nature, there would probably be little need to have recourse to the use of medicines.

I shall endeavour to point out the means best suited for the majority of patients in the different stages of gout; but, all who have had experience in clinical medicine must be fully aware, each individual case not only exhibits its own peculiarities and becomes a separate study, but demands, in certain respects, a special treatment. The neglect of this consideration, which is apt to lead to a routine practice somewhat closely bordering on quackery, has thrown no little obloquy on the science of medicine.

Treatment of Acute Gout.—When called to a patient suffering from an early and acute fit of the disorder, we should to a great extent follow the rules which apply to the treatment of ordinary inflammation of equal intensity, but always bear in mind that we are dealing with a disease originating in a peculiar condition of the whole system, and which is capable of considerably modifying the various symptoms that may present themselves. Except under peculiar circumstances, a strict antiphlogistic diet should be enforced, and as the appetite is sometimes keen, this is not always easily accomplished. Experience convinces me that in many instances a fit of gout is prolonged to an unnecessary degree from sufficient regard not being paid to this point, and many patients have informed me that, whereas under a regimen in which animal food was allowed, they were accustomed to suffer many weeks from each paroxysm, under a properly restricted diet their attacks have passed off in an equal number of days. The error of allowing animal food in such cases has arisen not only from a wish to gratify the patient's appetite, but from a very prevalent idea that it is of importance in gout to guard against the occurrence of debility, and that this object can be secured by such means. On consideration, however, it must be evident that the lowering of the system induced by the long continuance of inflammatory disease far exceeds the trivial debility which can possibly be caused by the necessary abstinence; and moreover, in most patients thus circumstanced, although appetite be present, the digestive powers are weakened, and animal food taken at such times aids greatly in augmenting the impurity of the blood, and consequently increasing the gouty condition of the habit; in addition to which, such a diet has a tendency to keep up a febrile state of system which is always to some extent present in these cases.

The rules of diet in cases of acute sthenic gout may be thus shortly summed up. For the first few days, until the disease has shown a decided inclination to abate, indicated by diminished tension of the skin, mitigation of the pain, and the ready production of pitting, a tongue less loaded and the bowels and other secretions free, the patient should be confined to a diet consisting of little more than diluents and farinaceous food. Such would include bread, arrowroot, sago, tapioca, and the like, with milk, thin gruel, barley or toast-and-water, and also weak tea. The drinking freely of diluents is of advantage, as it keeps up the action of the skin and kidneys, but stimulating or alcoholic beverages should be strictly forbidden, or the fit will be greatly prolonged; in proof of which assertion I may mention that a lady once informed me that she had suffered from an attack of gout for the space of six months, and the only cause to which such a lengthened duration could be attributed was the circumstance of her having taken two or three glasses of port wine every day, on account of feeling great prostration.

Now and then, it is true, circumstances arise which render it advisable to relax somewhat; but I am convinced their occurrence is rare in the form of the disease we are now considering, and we should not too readily be led to deviate from the prescribed plan from the mere sensations of the patient, but be guided by the state of the pulse and other objective rather than subjective symptoms. When the febrile disturbance has abated and the local affection has become distinctly relieved, a return to a more nutritious diet may be allowed, taking care that nothing likely to cause indigestion be given; beef-tea at first, and then white fish, afterwards fowl or tender meat, but this latter in moderate amounts only, for we must remember that everything beyond what is absolutely required for the nourishment of the body only feeds the disease. Even now it is most imprudent to have recourse to alcoholic stimulants, but if really necessary to promote digestion, which now and then occurs, a very small quantity of brandy may be given, freely diluted either with plain or aërated water; hollands or whiskey may be substituted for brandy. If wine be taken, a little sound sherry is most suitable; but we must remember that wines of all kinds possess a much greater power both of inducing and exciting gout than distilled spirits. Malt liquors should be altogether prohibited, as especially prone to cause a recurrence of the paroxysm.

When febrile disturbance is present to any extent in acute gout the patient should keep his bed at least for a day or so, as too early exposure and exertion sometimes cause the inflammation to leave the joints and implicate more important organs, and instances in which the brain has thus become affected, and delirium produced are not uncommon. On the other hand, too much warmth and inactivity is decidedly injurious, inducing debility, and preventing the due action of the various organs of the body. In former times many advocates were found for attempting to drive off the paroxysm by extreme exertion; which may perhaps be sometimes successful when a mere threatening exists, but not when the inflammation has established itself. On the subsidence of the fit, moderate and gradually increased exertion is of much service, and likely to prevent the injured joint from remaining stiff and weak.

The medicinal treatment of gout may be simply constitutional, or both general and local.

The constitutional treatment should be directed towards the diminution of inflammation and febrile disturbance, and the restoration of the blood to a healthy condition. To effect the first of these objects the methods employed to subdue ordinary inflammation may be resorted to, such as keeping up the secretions from the different organs by purgatives, and saline diuretics or diaphoretics; diminishing the force and frequency of the pulse by vascular sedatives; and alleviating the pain, if necessary, by the use of anodynes. The second object is best attained by giving remedies which have a special influence upon the composition of the circulating fluid. We will next endeavour to point out the efficacy of these several means of combating a fit of gout, but it must be remembered that our remarks on some of these special remedies will not be confined to their employment in the acute attacks of the disease.

Purgatives.—Some have altogether condemned the use of purgatives in gout; others have been loud in their praise. Among the former may be mentioned Sydenham, Mead, Boerhaave, and many French physicians; among the latter, Hoffman, Sutton, and Sir C. Scudamore. Sydenham carried his idea of the danger of purgatives in gout to an extreme, as will be seen in the following passage from his Treatise. "Sure I am that all purging, mild or sharp, intended to relieve the joints, is mostly injurious, whether it be during a fit to diminish the peccant matter, at the end of one to dissipate the remnants of the disease, or during an intermission to guard against the occurrence of one. From myself and others I have learnt that purges bring on what they were meant to keep off." He then goes on to explain how purgatives act injuriously under these different circumstances, and how in his own person they had completely failed to accomplish the desired object; and he asserts that he has known persons persevere in this method most rigorously, and yet remain not only tormented with gout, but in an aggravated form. Sir C. Scudamore, on the other hand, acting upon the indications afforded by his own view of the nature of gout, and considering that it was closely connected with portal congestion, gave purgatives very freely, and more especially those which produced a cholagogue effect. He commonly employed a combination of calomel, antimonial powder, and the compound extract of colocynth, repeating it each night or every second night, according to the character of the evacuations and the advantages which appeared to be derived from the treatment; along with these he was in the habit of ordering a draught containing sulphate of magnesia, burnt magnesia, and the acetic extract of colchicum, which had the effect of keeping up the action of the bowels.

In speaking of the value of purgative medicines in the treatment of gout, I purposely exclude the preparations of colchicum, not that colchicum does not act as a powerful cathartic, but because it certainly does not owe its efficacy to this property, and frequently proves of most benefit when its operation is unattended with increased alvine evacuation. My own experience has taught me that in the acute stages of the disease, purgatives possess no peculiar power of lessening the articular inflammation, and can therefore in no way be depended upon for effecting this object. I am induced to make this remark, being aware that some practitioners look upon the curative action of colchicum as due to its cathartic properties, and have an idea that a like amount of purgation excited by other remedies would answer the same purpose.

Of the incorrectness of this opinion I am fully convinced from repeated clinical observations, and from the results of trials made to determine this point, which will be related when we are discussing the therapeutic powers of colchicum.

Purgatives given in moderation are undoubtedly of value in many cases of acute gout, more especially, when accompanied with constipated bowels, retention of the bile, and hepatic congestion; but their efficacy under such circumstances simply depends on their restoring, to a healthy state, functions previously deranged, and not on their producing any specific effect either upon the affection of the joints or the state of the blood. It is very questionable if in gouty cases the secretion from the mucous membrane of the bowels induced by the operation, even of hydragogue purgatives, contains any amount of uric acid, and certainly not sufficient to relieve in any sensible degree the overloaded state of the blood: we can neither reasonably hope, nor do we find, from the action of hydragogues in gout the relief which so frequently follows their administration in cases of albuminuria, or in the anasarca dependent on cardiac disease. On the other hand, purgatives if given so as to cause marked depression of the system are decidedly injurious, for although perhaps some temporary mitigation of suffering may be afforded to the patient, yet the disease is rendered more liable to recur and assume a chronic and often asthenic form. The amount of cathartism must be determined by the peculiarities of the individual case, for that which in one would not be followed by any appreciable inconvenience, in another may be attended with serious prostration.

With regard to the kind of purgatives most suitable in the treatment of gouty inflammation, this must also depend on individual peculiarities; if mere constipation exists without sensible derangement of the hepatic function, the simple laxatives or milder cathartics may be employed, such as manna, magnesia, rhubarb, senna, or aloes, or compounds of these, as Gregory's powder, the compound rhubarb pill, compound colocynth pill, and the ordinary black draught, sufficient only being prescribed to insure the absence of excrementitial matter in the alimentary canal. If, however, the liver be in fault, other purgatives may be advantageously employed, and those should be selected which are known to possess an influence over the secretion of this organ. Small doses of a mercurial preparation, as calomel or blue pill, combined or not with the colocynth pill, may be occasionally given at night, and followed in the morning by the ordinary black draught. In some patients the addition of a little of the acetic extract of colchicum to the colocynth will answer the purpose of the mercurial; others again are benefited by the combination of the mercurial and colchicum.

Saline purgatives are fitted for certain strong and plethoric habits, and the sulphate of magnesia, tartrate of potash, and similar salts may now and then be given with advantage, combined or not with senna, rhubarb, or jalap and some aromatic; at the same time powerful hydragogue action should be avoided.

All that requires to be said with regard to purgatives in gout may be summed up in a few words. Purgation must not be trusted to as a curative agent, and if employed to the extent of causing much depression of the system is decidedly injurious, rendering the disease more obstinate in its character; but, when necessary such an amount should be induced as to prevent the system from being irritated by the retention of excrementitial matters, and likewise to restore the functions of the liver and relieve congestion of the portal system. The purgatives should be selected according to the requirements of each case, and no more administered than necessary to fulfil these.

It is scarcely necessary to allude to the use of *Emetics* in the treatment of gout, as they are only called for in exceptional cases. If at the commencement of a fit the stomach be greatly loaded and oppressed, an emetic may afford relief, but no influence appears to be exerted on the progress of the attack. The use of these remedies in the treatment of gout has been advocated by some physicians, and Dr. Small was accustomed to use them in his own case, employing tartar emetic combined with cinchona bark.

Mercurials.—The use of some preparation of mercury as a purgative has been already mentioned as occasionally of advantage in the treatment of acute gout, but I must here impress on my professional readers the great importance of caution in its administration, and more especially to gouty subjects in whom there is reason to suspect an injured condition of the kidneys. In these cases mercurials, if given beyond the amount necessary to act as hepatic alterants, may be productive of most injurious consequences, and I have witnessed profuse salivation brought on by the administration of only two grains of calomel. Sir C. Scudamore, who used mercury rather freely as an alterative, and considered that, if employed with judgment and caution, it was the most valuable agent in the Materia Medica for effecting the desired change of action in the different secreting organs connected with digestion, at the same time appeared to be impressed with the fact that when given in repeated doses it was liable in gouty subjects to be followed by serious evil, and in support of this opinion instances several illustrative cases. It can be also shown that mercury does not exert any specific control over gouty inflammation, and hence, except with a view to its immediate purgative effect, and the augmentation of the hepatic function, it should not be administered. In advanced forms of gout the use of mercury should be altogether avoided.

Diuretics and Diaphoretics.—These remedies are often of much service in acute gout, in which it commonly happens that the urine is deficient in quantity, and the skin hot and dry. The action of the kidneys can usually be promoted by the use of such saline remedies as the acetate, citrate, tartrate, nitrate, or bicarbonate of potash in small doses, or by the phosphate of soda or sulphate of magnesia given in quantities insufficient to produce purgatives. Most of these salts likewise possess the power of altering the condition of the blood, rendering it more alkaline and thus prove of considerable service in acute gout; on this point we shall have occasion to dwell more fully when speaking of the treatment of the chronic affection. When it is desirable to induce diaphoresis, the acetate of ammonia may be given for the purpose, taking care to aid its action by the free use of diluents. In some cases it may be advisable to promote the action of the skin by the aid of the hot air or vapour bath, but these instances are few in the regular forms of gout; the same may be effected by the use of tepid sponging with water or vinegar and water, but great caution must be used to avoid anything like a chill to the surface.

Anodynes and Narcotics.—As an acute gouty fit is often accompanied with intense pain, the question of the propriety of giving direct anodynes is one of some importance. That opium often speedily relieves the pain of gout there cannot be a doubt, but is its action followed by injurious consequences? Cullen thus answers the question: "Opiates give the most certain relief from pain, yet when given in the beginning of gouty paroxysms, they cause them to return with greater violence." Sydenham also was averse to its employment except under special circumstances. My own experience has led me to form a very similar opinion, and, unless the pain of gout be excessive, or there be fear that if not relieved the patient's nervous system will suffer, I always feel disposed to withhold its administration, and trust to other means, as opium tends so powerfully to diminish the secretions and aggravate congestion of the portal system.

When opium is really required, it may be given either in the solid form or in that of the tincture, or of any salt of morphia. It is then desirable to combine it with a sudorific and purgative, in order to avoid as much as possible its baneful influence upon the secreting organs. The compound powder of ipecacuanha is a useful form.

With regard to other anodynes, as henbane, belladonna, and so forth, instances may occasionally occur demanding their use, but these depend more upon the idiosyncrasies of the patients than the form of the disease. Henbane, for example, often produces a soothing effect in individuals in whom opiates cause much nervous disturbance, and both henbane and belladonna possess the advantage of not diminishing the secretions. Aconite has been recommended by some, but its value in gout is by no means yet established.

Blood-Letting.—In the treatment of an attack of acute gout the question of the value of blood-letting naturally arises; and although its discussion would have had more importance in former days before the use of the lancet had fallen so much into disuse, it still affords enough of interest to allow us to devote a few lines to its consideration.

Sydenham, although he thought bleeding by no means a remedy capable of curing gout, yet under certain limitations sanctioned its employment, as will be seen from the following passage: "Nevertheless, if the patient be young, and have drunk hard, blood may be drawn at the beginning of the fit. If, however, it be continued during the following fits, gout will take up its quarters even in a young subject, and its empire will be no government, but a tyranny." Cullen also, no advocate for much interference in gout, thinks some means may be taken with advantage to moderate the inflammation, especially in the young and vigorous, and in early paroxysms, and that bleeding may then be useful; but he is persuaded that it cannot be repeated with safety. From the qualified tone in which the opinions of these eminent men were announced, it is evident that although they occasionally allowed, they did not put much faith in this remedy; and in spite of the advantages of general blood-letting having been strongly insisted on by some physicians, as Drs. Hamilton, Rush, Huxham, the profession at large seems, at the present day, to be tolerably unanimous upon the point, and considers it a means which should only be resorted to in exceptional cases.

Dr. Todd considers that blood-letting by inducing asthenia causes a greater disposition for the inflammation to shift from place to place; but Dr. Gairdner states that in several cases of gout he has obtained much advantage from the use of small bleedings, as will be seen in the annexed quotations: "There are cases of plethora and atonic gout, which, but for this remedy, would have baffled me, and yet were speedily and very thoroughly relieved by its aid;" and, "It is with me no matter of doubt, but of absolute certainty, that in instances of this kind, much suffering may be saved and no injury done, by the practice I have recommended;" but it is right to add another quotation in which he says, "It is necessary I should state that I never make use of this remedy in, and I consider it wholly inapplicable to, cases of gout in an impaired or defective constitution, even though there be evidence of plethora in the system. I believe that some considerable energy is necessary to its legitimate use, but this is generally met with in the early stages of gout."

Bleeding is certainly not curative of gouty inflammation, and, therefore, cannot be looked upon as a remedy having any specific powers in these cases. It can neither remove the impurity of the blood, nor the deposit which has taken place in the inflamed structures; the only advantage which can possibly be derived from its use, is the relief of plethora, which is usually present in the febrile attack; but this can generally be more safely effected by other and milder means. I have occasionally met with patients with acute gout who have apparently experienced distinct relief from small venesections, but I have in no instance abstracted more than five or six ounces of blood, frequently even less, and never sufficient to cause the slightest permanent debility. From my own experience I am convinced, that whenever blood-letting has been carried to an extent to cause subsequent depression,—and I have seen several cases where it has been so employed,—its effect has been to render the attacks more frequent and prolonged, without any advantage in the mitigation of the paroxysm.

The following rules as to the use of bleeding in gouty cases may be safely relied upon :—

Never bleed with the idea of directly subduing gouty inflammation.

Never bleed in advanced gout, or when the constitution is much weakened.

If bleeding be required in order to relieve general or local plethora,—and the former, at least, scarcely ever occurs in large cities,—abstract only so much as will effect that object, remembering that further depletion tends greatly to aggravate the disease and prolong its duration.

Lastly, under the head of the General Treatment, we have to consider the value of a remedy which has now for some years been extensively employed in all the stages and varied phases of gout. I allude to *colchicum;* but as the subject of its administration is of great importance, and one upon which many discordant opinions exist at the present time, its discussion will be reserved for the next Chapter, in which will be found all that has been clearly made out, not only as to the value and best mode of employing the drug, but also as to its effects upon the animal economy, and the mode in which such results are produced.

Local Treatment of Acute Gout.—Should we leave the inflamed joints to themselves, or should we have recourse to local treatment? This question is of some practical importance to decide correctly, for the patient, naturally anxious for a speedy relief to his sufferings, is prone to think that remedies directed immediately to the painful part are most likely to effect the desired object; the physician on the other hand may be inclined to regard constitutional treatment as most efficacious, and to look upon local applications as not altogether unattended with danger. It will, therefore, be desirable to pass in review some of the principal means which have been proposed, and endeavour to ascertain their real value.

Leeches.—Our knowledge of the pathology of common inflammation and of the marked benefit derived from local depletion, would lead us to suppose, that the condition of a joint in acute gout would be immediately relieved by leeches, and it is not very unusual to find recourse had to them under such circumstances. Experience does not sanction their employment; for sometimes their application has been followed by a transference of the inflammation either to some other joint, or to an internal organ, sometimes by the occurrence of a diffuse form of inflammation. It has been also thought by some physicians, that although leeches may occasionally give temporary ease, the recovery is thereby prolonged, and permanent weakness of the joint induced. If we direct our attention beyond the mere appearance of the joint, and reflect upon the intimate nature of gout, and view the inflammation as only the local manifestation of a morbid condition of the whole system, some explanation will at once be afforded of the comparative inefficiency of local depletion.

I have never ordered leeches to be applied to a gouty joint, considering that in no case are they likely to prove efficacious, and that their use may be attended with injurious consequences; and from what I have witnessed of the results of their application where I have been subsequently consulted, I do not feel disposed to alter my view of their inutility.

Blisters.—The use of blisters as a local remedy in gout is by no means of modern introduction; about a century ago, a woman at Horsham was accustomed to sell a plaster which gained much reputation in such cases, and which after the purchase of the secret, was discovered to consist simply of the ordinary blistering cerate. In 1770, Dr. Cartwright tried blisters with complete relief to pain, and Sir B. Shelley is said to have used them for nearly sixty years, when suffering from attacks of this disorder. The blister should not be large, varying in size from a shilling to half-a-crown, and after vesication has been produced, it should be removed and the part allowed to heal; it may be afterwards repeated if necessary.

Within the last few years, Dr. Todd has advocated small blisters in the treatment of gout, and uses them as above indicated. From having myself employed them in many cases, I have formed the following conclusions of their value, and of the circumstances under which they are needed.

Blisters are unnecessary in the early fits of sthenic gout, when the joints are not appreciably injured by prior attacks.

They are contra-indicated in advanced gout, when the excreting power of the kidneys has become impaired; and especially in cases of extreme gouty deposits, as sores may be then induced which may prove difficult to heal.

Blisters are of most advantage in cases of gout of a somewhat asthenic character, when the inflammation has a tendency to linger in the articulations and cause liquid effusion. A rational explanation may be given of the value of blisters in chronic and asthenic forms of gouty inflammation, as by their means a stimulus is given to the local circulation, and the action is directed from the tissues within the joint to the surrounding skin; besides which a certain amount of serous exudation is produced, rich in the matters causing the impurity of the blood, which of itself would be attended with benefit.

The moxa has now and then been advised in gout, and was used by Sir William Temple with considerable relief.

Many other applications have been at various times suggested by different practitioners, and some of them are deserving of attention.

Warmth to the inflamed joints has been commonly advised, which has been effected by enveloping them with soft new flannel or carded cotton surrounded by a light covering of oiled silk; hot fomentations and poultices have also been employed. Some practitioners have objected to the application of warmth in any form, under the idea of its causing too much relaxation and subsequent weakness, but it is very questionable if the objection to the use of carded cotton is at all valid.

Sir C. Scudamore strongly advocated the use of tepid *evaporating lotions* to the inflamed joints, and for this purpose advised a mixture of one part of rectified spirit and two parts of camphor mixture. He states in his works that he had used this solution lukewarm applied by means of linen rags, and had found it very successful; he recommends a temperature of 75° to 85° Fahr. The linen compress should consist of six or eight folds laid one upon another, and kept constantly wet with the lotion; and in the night when this precaution cannot be always employed, a layer of oiled silk will prevent the rapid evaporation and drying of the cloth, but not produce too great heating. Sir C. Scudamore remarks that even the very free use of this lotion has no tendency to produce retrocession of the disease.

Not having had much experience in this method of local treatment I can offer no opinion as to its efficacy, but at the same time am inclined to consider all such applications uncalled for in the majority of gouty cases.

Now and then when the pain is very intense, relief is given by *anodynes*, and preparations of opium, belladonna and aconite have been used for the purpose. Those of belladonna are perhaps of most service, and an elegant method of applying the drug is in the form of a solution of atropine, made by dissolving from two to three grains of the alkaloid in a weak mixture of spirit and water, and applying it to the inflamed joint by means of compresses of lint or a few folds of linen, preventing evaporation by a covering of oiled silk.

Occasionally physicians, from regarding gout as a simple local affection, have had recourse to the application of *cold*, and sometimes patients with an idea of thus obtaining rapid relief from their sufferings have tried the same of their own accord: for this purpose the limb has sometimes been immersed in cold water, or even snow has been directly applied.

Such a plan of treatment is always fraught with the greatest danger, and cannot possibly be advocated on any rational view of the nature of the disease; for not only is it apt to cause retrocession of the articular inflammation, and the sudden and serious affection of some internal organ, but even when no such evil results, does it more than temporarily assuage the pain, and exerts no lasting influence over the severity or duration of the paroxysm.

The management required in an ordinary attack of acute gout may be thus shortly summed up:

The diet should be very light and chiefly amylaceous, diluents freely used, but no alcoholic stimulants allowed, unless in exceptional cases.

The medicinal treatment should consist in the administration of some simple alkaline saline, combined with a moderate dose of colchicum. If necessary, purgatives may be given, selected according to the habit and condition of the patient. In the majority of cases, this will be found to be all that is necessary, but in some instances certain modifications may be essential; for example, if there be great plethora the question of the abstraction of a few ounces of blood may possibly arise; and on the other hand, if the vital powers are at a low ebb and great vascular and nervous depression exists, ammonia, in the form of the sesquicarbonate, may be desirable in addition to, or as a substitute for, other salines; at the same time the colchicum should be altogether omitted, or used with the greatest caution.

The only local application required in the majority of cases is cotton wool covered lightly with oiled silk, which forms a protection to the joint; but now and then an anodyne may be advantageously used, and a small blister is occasionally of service.

CHAPTER XI.

TREATMENT OF GOUT.—COLCHICUM—IMPORTANCE OF THE STUDY OF ITS MODE OF OPERATION—THE HERMODACTYLUS OF THE ANCIENTS PROBABLY A SPECIES OF COLCHICUM—CHEMICAL COMPOSITION OF COLCHICUM—ITS PHYSIOLOGICAL ACTION—CURATIVE EFFECTS NOT EXPLAINABLE BY ITS PURGATIVE PROPERTY—ITS INFLUENCE ON THE CIRCULATING SYSTEM—ON THE URINE—DR. CHRISTISON'S EXPERIMENTS—OBSERVATIONS OF PROFESSOR CHELIUS—AUTHOR'S ANALYSES EXHIBITING THE EFFECT OF COLCHICUM ON THE URINE —DEDUCTIONS THEREFROM—MODE OF EMPLOYING COLCHICUM IN THE TREATMENT OF GOUT—THE QUESTION DISCUSSED AS TO ITS LIABILITY TO CAUSE MISCHIEF—DIFFERENT PREPARATIONS OF COLCHICUM—WHITE HELLEBORE IN GOUT—OBSERVATIONS ON ITS ACTION.

As Colchicum is a drug extensively employed in the treatment of gout, and though condemned by some, regarded by others as worthy of being called a specific for the disease, it will not be out of place to devote a short Chapter to its consideration, and endeavour to ascertain its real nature and the manner in which its influence upon the system, for good or evil, is exerted.

Among the later Greek and Arabian physicians, a medicine called hermodactyl (ἑρμοδάκτυλος, from Ἑρμῆς Hermes or Mercury; and δάκτυλος a finger) was in great repute as a remedy for arthritic diseases, being first mentioned by Alexander of Trales, about A.D. 580; Paulus Ægineta, Avicenna, Serapion and Mesue, likewise allude to it.

Under the name of Surugen or hermodactyl Serapion comprehends the κολχικόν and ἐφήμερον of Dioscorides, and the ἑρμοδάκτυλος of Paulus, and by some of the older writers, the hermodactyl was called anima articulorum, or the soul of the joints. Dr. Pereira considered that the corms brought in modern times from Oriental countries under the name of hermodactyls answer the description given to the ancient substance bearing the same name, and he was therefore induced to believe that they were identical, or at least, the under-ground stems of some species of colchicum, but not those of colchicum autumnale. The hermodactyls have not been submitted to the test of physiological experiment in this country, though from the description of those employed in the treatment of joint affections by Paulus Ægineta, it seems that in this respect they resembled our ordinary colchicum, for he says, "Some, in the paroxysms of all arthritic disease, have recourse to purging with hermodactylus; but it is to be remarked, that the hermodactylus is bad for the stomach, producing nausea and anorexia, and ought therefore, to be used only in the case of those who are pressed by urgent business, for it removes rheumatism quickly and after two days at most, so that they are enabled to resume their accustomed employment."

The Colchicum Autumnale, or Meadow Saffron, has only been employed within the last century, having been introduced as a medicine by Baron Störk, in 1763; it is probably the active ingredient of the celebrated Eau Médicinale, which was first employed about this time by M. Husson, a military officer in the service of the King of France.

Colchicum Autumnale belongs to the natural order Melanthaceæ, in which it is associated with several other plants possessing powerful effects on the animal economy, as for example the Veratrum album or white hellebore, the Veratrum viride, and the Assagræa officinalis or cevadilla. The corms and seeds are the parts mostly employed in medicine, but the flowers have been occasionally used; when chemically examined, all parts of the plant are found to possess a bitter and somewhat acrid taste, evidently depending on the presence of a peculiar principle.

At first on the authority of Pelletier and Caventou, the bitter and active matter of colchicum was supposed to be the same as that which exists in the veratrum album and cevadilla, this however, is erroneous. Geiger and Hesse subsequently asserted that they had obtained an alkaloid from the colchicum plant, which they named Colchicia, differing from veratrine in many properties, being crystalline, soluble in water, alcohol, and ether, bitter in taste, but devoid of the irritating or sternutatory effects possessed by veratrine, and giving with nitric acid a beautiful violet colour, quickly changing first to indigo, then to green and yellow. Many chemists have endeavoured to obtain crystallised colchicia, since the announcement of Geiger and Hesse, but I believe without success. In 1856, M. Oberlin re-examined the subject and the following are the results of his investigation: He was quite unable to obtain the alkaloid described by Geiger and Hesse, but has separated another principle, which he has named Colchiceine, almost insoluble in water, but soluble in alcohol, ether, and chloroform, neutral and giving with nitric acid the beautiful violet colour above described. M. Oberlin considers that it pre-exists in the colchicum plant, and it appears to produce the peculiar action of the drug.

The physiological effects ascribed to colchicum, are those of a powerful topical acrid and nervous sedative; on the lower animals, such as the dog, it causes when injected into the veins, loss of all voluntary power, extreme slowness of breathing and also considerable diminution in the rapidity and force of the pulse; vomiting and bilious purging are also produced; the pulse afterwards becomes rapid and irregular, the breathing hurried and death ensues. After death the mucous membrane of the stomach and duodenum, and other parts of the internal canal, are found to be congested and inflamed. Cases of poisoning in the human subject from colchicum are likewise on record, and the effects most uniformly observed have been vomiting, purging, and tenesmus, slow, weak and often intermitting pulse, coldness of the extremities, and great prostration of strength; convulsions and coma are seldom produced. When administered in therapeutic doses, colchicum is regarded as possessing considerable power over the secreting and excreting functions, more especially of the intestinal mucous membrane. If the dose be large, and especially if frequently repeated, it purges, and not uncommonly produces nausea and vomiting; and its influence upon the liver is readily recognised by the appearance of the fæces and vomited matters; it is generally regarded as possessing a diuretic action, and likewise considered to alter the composition of the urine, increasing the amount of the solid portion, and more especially of uric acid and urea; whether these latter suppositions be correct we shall presently endeavour to show from the results of our own investigations.

That colchicum in its various forms and preparations, has a most powerful influence upon the progress of gouty inflammation is undeniable, and this action is not simply limited to the removal of gout when it attacks the joints, but it proves efficacious even in its masked and irregular forms. Sir Henry Holland states, that from experience, he can assert that the influence of colchicum is striking and well defined in the chronic forms of the constitutional disorder, as in the peculiar ophthalmia of gouty habits, in gouty bronchitis and also in a class of headaches connected with this diathesis. My own experience fully coincides with that of Sir H. Holland, and I would even go the length of asserting that we may sometimes diagnose gouty from other forms of inflammation, by noting the influence of this drug.

Many physicians consider that purging is necessary in order that relief may be obtained by the use of colchicum, but the opinion of those who have had most experience in the use of the remedy militates against this view, as likewise my own observations, which prove in addition that brisk purging produced by other means is not productive of the same beneficial effect. I have often found relief speedily afforded to patients suffering from excruciating pain, without any appreciable discharge being caused by the colchicum. One patient whose attacks were very severe, and who had been accustomed for a long time to take the drug without medical advice, stated that in two or three hours after taking a two-drachm dose of the colchicum wine, he felt himself in paradise, yet no action of the bowels had been produced; and in another instance when I ordered a drachm and a-half of the same preparation for a single dose and without the addition of any other medicine, most rapid alleviation of pain was experienced, yet not attended with any purging or sensible evacuation. To show the want of efficacy of simple purging in controlling gouty inflammation, I may mention the case of a man about 32 years of age, who had brought on gout by free living and indulgence in large quantities of malt liquors, and was suffering with his seventh attack, having numerous joints affected, with a pulse at 108 full and hard, tongue furred, thirst, skin hot and dry. A draught containing two drachms of sulphate of magnesia and a scruple of the carbonate suspended in an ounce of cinnamon water was administered three times a day, which freely purged the patient, causing yellow watery stools. The gouty affection after two days of this treatment was not sensibly relieved, and the draught was consequently omitted, and drachm doses of colchicum wine administered. After another two days he expressed himself as having soon found relief from the fresh medicine, having had no pain during the past night, and the bowels had only been acted upon once since the last visit; the joints were now much relieved, somewhat tender, but not painful when at rest, the pulse soft, 72, and no feeling of nausea.

This case plainly shows that colchicum will give ease without inducing purging, and also that other purgative medicines may be freely given without a similar result. I selected the sulphate and carbonate of magnesia, inasmuch as they form the ingredients of a favourite colchicum mixture, and it has been occasionally supposed that the relief afforded by it depends on the salts rather than the colchicum. I have made many trials both of these and other purgatives, and feel assured that although colchicum often does induce free action of the bowels at the time that relief of the gouty pain is obtained, still this is not essential to the production of its beneficial influence.

Does colchicum act as a sedative on the vascular system, and thus relieve the inflammatory action? It undoubtedly produces a decided sedative action on the heart and other parts of the circulating system, as is manifest from the slowness of the pulse which it causes, as well as from the peculiarity of its character.

Dr. Maclagan, for example, found that 20 minims of colchicum tincture produced on two occasions the following effect on his own pulse:—

FIRST OBSERVATION.					SECOND OBSERVATION.				
At	8,	P.M.,	Pulse	87	At	6,	P.M.,	Pulse	84
,,	9,	,,	,,	87	,,	7,	,,	,,	84
,,	10,	,,	,,	80	,,	8,	,,	,,	78
,,	11,	,,	,,	75	,,	9,	,,	,,	72
,,	11½,	,,	,,	70	,,	10,	,,	,,	66
,,	12,	,,	,,	65	,,	11,	,,	,,	60
,,	12½,	A.M.,	,,	65	,,	12,	,,	,,	62

No other physiological action was manifested except slight nausea.

If the sole action of colchicum depends on its sedative property, we should expect to find it equally efficacious in other inflammatory affections; and although it possesses some controlling power in such cases, it is by no means well marked and not at all equal to that produced by such drugs as tartar emetic and calomel; and furthermore these latter medicines, so powerful in other diseases, exert no such decided influence as colchicum over gouty inflammation.

If the action of colchicum cannot be explained either by its purgative property or its mere sedative influence on the vascular system, we are naturally led to seek if its effect on the kidneys and the urinary secretion will afford any clue to its *modus operandi.* Hence the questions arise: Does colchicum act as a diuretic? Does it cause the elimination of uric acid from the blood, or its destruction when already formed? or, lastly, Is its influence solely exerted upon the tissues in which the deposited urate of soda has given rise to inflammatory action?

Dr. Christison found that, after giving colchicum to a patient for two days, the quantity of urea was nearly doubled; before taking the drug, the urine had a specific gravity of 1020, contained two per cent. of urea, and was free from any deposit of urates; but, during the first and second days after commencing the medicine, the urine was of the densities 1033·5 and 1034, turbid from urate of ammonia, and the second specimen yielded at least 3·5 per cent. of urea. At first sight this experiment would appear to show a marked influence of colchicum in increasing the elimination both of urea and uric acid; but on further investigation a source of error will be discovered. Dr. Christison took specimens of urine for analysis, without reference to the quantity passed in the twenty-four hours, so that, although, after the administration of the colchicum, a given sample was richer in urea and uric acid, no proof was afforded that their total daily elimination was augmented; on the contrary, they might have been decreased, for a notable diminution in the quantity of the urinary secretion often occurs from the purgative action of the colchicum.

Dr. J. Mc Grigor Maclagan, who made similar experiments, arrived at like results, the analyses being made on specimens of urine passed at particular times of the day, with no attempt to show the daily averages of these principles.

As closely connected with the subject I may mention that Professor Chelius, of Heidelberg, made some experiments, the results of which are apparently in favour of the idea that colchicum relieves by increasing the secretion of uric acid by the kidneys. He found in one case the quantity of this acid was nearly doubled in the space of twelve days, but it must be remembered that the observations were made in a gouty subject, and one recovering from a recent attack of the disease; and, as remarked in our Chapter on the urine, these circumstances would alone be sufficient to vitiate the experiments, for during convalescence the same phenomenon may occur without the administration of any medicine.

In opposition to these statements it should be remarked that Dr. Graves regards the power of colchicum to be due to its lessening the formation of uric acid in the system, and not to any increased elimination by the urine.

I have made the following observations with the view of ascertaining the action of colchicum upon the urinary secretion.

The first patient, a man, W. L., aged 30, suffering from a slight chronic eczematous eruption, his general health being good, was, at the time the examinations were made, placed upon a regulated diet, and the urine carefully collected, so as to avoid fallacy.

Before taking colchicum.

Oct. 30.	Urine, 56 fl. ozs. ;	sp. gr. 1016.	Uric acid in 24 hrs.	= 8·73 grs.
,, 31.	,, 64 ,,	,, 1014.	,, ,,	= 7·9 ,,
Nov. 1.	,, 84 ,,	,, 1012.	,, ,,	= 8·09 ,,
,, 3.	,, 66 ,,	,, 1016.	,, ,,	= 8·18 ,,

Average: Urine, 68·5 fl. ozs. Uric acid = 8·24 grs.

When taking colchicum.

Nov. 4.	Urine, 56 fl. ozs. ;	sp. gr. 1015.	Uric acid in 24 hrs.	= 6·05 grs.
,, 5.	,, 56 ,,	,, 1016.	,, ,,	= 8·51 ,,
,, 6.	,, 46 ,,	,, 1020.	,, ,,	= 8·00 ,,
,, 7.	,, 56 ,,	,, 1016.	,, ,,	= 6·61 ,,
,, 9.	,, 54 ,,	,, 1021.	,, ,,	= 9·18 ,,

Average: Urine, 55·6 fl. ozs. Uric acid = 7·67 grs.

The next patient was a young man, C. W., aged 19, suffering from a chronic affection of the upper lip (elephantiasis), but whose general health was pretty good. During the time the analyses were made, the diet was uniform; and every precaution taken to secure accuracy in the results.

Before taking colchicum.

Jan. 13. 1854.	Urine, 55 fl. ozs. ;	sp. gr. 1017.	Uric acid in 24 hrs.	= 7·91 grs.
,, 14.	,, ,, 28 ,,	,, 1027.	,,	= 4·48 ,,
,, 15.	,, ,, 30 ,,	,, 1027.	,,	= 3·00 ,,

Average: Urine, 37·7 fl. ozs. Uric acid = 5·03 grs.

When taking colchicum (half a fluid drachm three times a day).

Jan. 16. 1854.	Urine, 47 fl. ozs. ;	sp. gr. 1015.	Uric acid in 24 hrs.	= 1·34 grs.
,, 18.	,, ,, 23 ,,	,, 1024.	,,	= 7·55 ,,
,, 19.	,, ,, 24 ,,	,, 1025.	,,	= 7·24 ,,
,, 20.	,, ,, 13 ,,	,, 1031.	,,	= 5·00 ,,
,, 22.	,, ,, 19 ,,	,, 1027.	,,	= 5·34 ,,

Average: Urine, 25·2 fl. ozs. Uric acid, 5·29 grs.

The colchicum was taken three times a day for two days, when, on the occurrence of purging, one dose was omitted; the two doses were sufficient to keep up a free action of the bowels.

The third case was that of a man, B. F., the characters of whose urine, during an acute attack of gout, are given in page 162, where it will be seen that during five days he passed the following amounts of uric acid: 1·30 grains, 1·95 grains, 2·73 grains, 2·14 grains, and 3·05 grains. Colchicum wine was afterwards administered in half drachm doses three times a day, combined with calcined magnesia, and was almost immediately followed by a marked improvement in the affected joints.

Under Colchicum.

Jan. 20. 1853. Urine, 43 fl. ounces; sp. gr. 1011. Acid.
Uric acid in the 24 hours = 2·58 grains.
,, 21. ,, Diarrhœa from medicine caused the loss of much urine.
,, 22. ,, Urine, 35 fl. ounces; sp. gr. 1012. Acid.
Uric acid in the 24 hours = 3·32 grains.
,, 23. ,, Urine, 47 fl. ounces; sp. gr. 1011. Acid.
Uric acid in the 24 hours = 3·99 grains.

On the 21st, the patient took but two doses of the medicine.
On the 22nd, but one, and then discontinued it.

Jan. 26. 1853. Urine, 74 fl. ounces; sp. gr. 1011. Acid.
Uric acid in the 24 hours = 4·07 grains.
,, 27. ,, Urine, 56 fl. ounces; sp. gr. 1011. Acid.
Uric acid in the 24 hours = 3·08 grains.

Before taking colchicum,

Average amount of uric acid passed in the 24 hours = 2·23 grs.

When taking colchicum,

Average amount of uric acid passed in 24 hours, 3·41 grains.

C. F., a male patient, on half extra full diet, not suffering from any very active symptoms, but having a large abscess discharging urate of soda and pus.

Under the influence of colchicum :—

Jan. 4.	Urine,	57	fl. ozs. ;	sp. gr.	1012.	Uric acid	in 24 hrs.	=0·58	grs.
,, 5.	,,	44	,,	,,	1013.	,,	,,	=0·06	,,
,, 6.	,,	44	,,	,,	1013.	,,	,,	=0·00	,,
,, 7.	,,	37	,,	,,	1012.	,,	,,	=0·14	,,
,, 8.	,,	48	,,	,,	1011.	,,	,,	=0·00	,,
,, 9.	,,	44	,,	,,	1011.	,,	,,	=0·00	,,

The diet the same, but without colchicum :—

Jan. 10.	Urine,	44	fl. ozs.;	sp. gr.	1012.	Uric acid	in 24 hrs.	=0·72	grs.
,, 11.	,,	34	,,	,,	1014.	,,	,,	=0·85	,,
,, 12.	,,	61	,,	,,	1013.	,,	,,	=2·44	,,
,, 13.	,,	55	,,	,,	1012.	,,	,,	=0·00	,,
,, 14.	,,	87	,,	,,	1009.	,,	,,	=0·00	,,

The averages being—

Under colchicum.	Urine,	45·6	fl. ozs. ;	uric acid	=0·13	grs.
Without medicine.	,,	56·2	,,	,,	=0·80	,,

J. L., a male, aged 57, has had several attacks of gout; a year or more generally elapses between each; for the first few years the ball of the great toe only was affected, the disease afterwards travelling upwards. No deposits of urate of soda are visible. During the time that the joints were severely affected the urine was scanty, high coloured, giving rise to a red urate sediment. At the time the quantitative analyses were commenced the patient was suffering from but slight affection of the joints, and no febrile disturbance was present; the disease however appeared to be hovering about him.

When taking no medicine :—

Feb. 7. Urine, 26·5 fl. ounces ; sp. gr. 1021, at 60° Fah. Clear.
Urea passed in the 24 hours = 213 grains.
,, 8. Urine, 28 fl. ounces ; sp. gr. 1020·5, at 60° Fah.
Urea passed in the 24 hours = 199 grains.
Uric acid, a few crystals, too small to collect and weigh.
,, 9. Urine 37 fl. ounces ; sp. gr. 2019, at 60° Fah.
Urea passed in the 24 hours = 259 grains.
Uric acid, only a few microscopic crystals.

Under the influence of colchicum :—

Feb. 10. Urine, 38 fl. ounces ; sp. gr. 1019, at 60° Fah.
Urea passed in the 24 hours = 209 grains.
Uric acid, a quantity too minute to collect.
,, 11. Urine, 32 fluid ounces ; sp. gr. 1021, at 60° Fah.
Urea in the 34 hours = 244 grains.
Uric acid in microscopic quantities only.
,, 12. Urine, 41 fl. ounces ; sp. gr. 1019, at 60° Fah.
Urea passed in the 24 hours = 270.
Uric acid, a trace only.
,, 13. Urine, 39 fl. ounces ; sp. gr. 1017·5 at 60° Fah.
Urea passed in the 24 hours = 241 grains.
Uric acid, a very few crystals, too small to collect.
,, 14. Urine, 33 fl. ounces ; sp. gr. 1021·5, at 60° Fah.
Urea passed in the 24 hours = 259 grains.
Uric acid, a trace.

The patient omitted colchicum at the last date, as some feeling of faintness was induced by its use.

Feb. 16. Urine, 30 fl. ounces ; sp. gr. 1020, at 60° Fah.
Urea passed in the 24 hours = 201 grains.
,, 19. Urine, 30 fl. ounces ; sp. gr. 1020, at 60° Fah.
Urea passed in the 24 hours = 201 grains.
,, 20. Urine, 42 fl. ounces ; sp. gr. 1017·5, at 60° Fah.
Urea passed in the 24 hours = 251 grains.
,, 21. Urine, 51 fl. ounces ; sp. gr. 1014·5, at 60° Fah.
Urea passed in the 24 hours = 279 grains.
No crystals of uric acid precipitated by the addition of hydrochloric acid.

Feb. 22. Urine, 54 fl. ounces ; sp. gr. 1013·5, at 60° Fah,
Urea passed in the 24 hours=250 grains.

Average before taking medicine :—

Quantity of urine passed in the 24 hours=30·5 fl. ounces.
Amount of urea ,, ,, =223·6 grains.

Average during the administration of colchicum :—

Quantity of urine passed in the 24 hours=36·6 fl. ounces.
Amount of urea ,, ,, =244 grains.

Average after omitting the use of the colchicum: —

Quantity of urine passed in the 24 hours=41·4 fl. ounces.
Amount of urea ,, ,, =236·4 grains.

The amount of uric acid was in no instance sufficient to collect and weigh.

H. C., a male, aged 51. Had suffered from many attacks of gout, but was not labouring under any acute affection at the time the urine was examined.

Urine before the administration of colchicum :—

Nov. 25.	Urine,	98 fl. ozs.;	sp. gr.	1008.	Uric acid in the 24 hrs.	=1·96 grs.
,, 26.	,,	72 ,,	,,	1012.	,, ,,	=3·12 ,,
,, 27.	,,	68 ,,	,,	1014.	,, ,,	=2·72 ,,
,, 28.	,,	60 ,,	,,	1014.	,, ,,	=3·00 ,,

Under colchicum (twenty minims of the wine three times a day) :—

Nov. 20	Urine,	68 fl. ozs.;	sp. gr.	1011.	Uric acid in the 24 hrs.	=1·81 grs.
,, 30.	,,	66 ,,	,,	1012.	,, ,,	=2·20 ,,
Dec. 1.	,,	64 ,,	,,	1012.	,, ,,	=2·13 ,,
,, 2.	,,	72 ,,	,,	1008.	,, ,,	=1·56 ,,

Average before taking medicine :—

Quantity, 74·5 fl. ozs. ; uric acid passed in the 24 hours=2·70 grains.

Average when taking colchicum :—

Quantity, 67·5 f. ozs.; uric acid passed in the 24 hours=1·88 gr.

Results of analyses.—The results of these observations on the action of colchicum may be thus summed up. In Case 1, where neither gouty affection nor febrile disturbance existed, colchicum appeared to have the effect of slightly diminishing the quantity of urine, and likewise decreasing the excretion of uric acid.

In Case 2, where the circumstances were similar, the influence of the medicine appeared to be to diminish notably the quantity of urine, the amount of uric acid being a little increased. This increase, however, was less than a quarter of a grain *per diem*, and might arise, at least in part, from a circumstance previously alluded to, namely, that uric acid is to some extent soluble in water, and therefore, when the urinary excretion is large, a portion escapes precipitation.

In Case 3, a gouty man recovering from an acute attack, the amount of uric acid was somewhat increased, but not more than frequently occurs in patients under like circumstances, where no medicine has been administered.

In Case 4, the colchicum appeared to cause a decrease both of the urine and uric acid.

In Case 5, when the examinations were made both before and after the administration of the colchicum, as also during the time the patient was taking the drug, the amount of uric acid appeared to remain about the same, but extremely small throughout. The urea was slightly augmented during the action of the medicine, but the increase formed only a small fraction of the total elimination of that principle. The quantity of the urine was also larger when the patient was under the influence of the drug, yet little stress can be laid upon the fact, as it continued to increase still more after its omission.

In Case 6, a gouty man, the excretion of uric acid became much less in amount, and the quantity of urine also smaller; but in this patient's urine considerable variations were observed, many of them totally irrespective of the action of remedies, a circumstance which renders the figures less valuable.

Besides the results we have just detailed, we have, in the chapter on the urine, given several other analyses, showing the influence of colchicum upon the urinary secretions. Thus, among the cases of acute gout, we find the patient (Case 4,) was under the marked influence of colchicum on the 19th and 20th of February, and the peculiarity of the urine consisted in its containing a very small amount of uric acid, compared with that present during the time the inflammation was severe. In Case 5, colchicum was given during the whole course of the attack, but as the dose was rather small, and the man had been long accustomed to its administration, the daily alteration of the uric acid observed in this patient's urine probably depended rather upon the different phases of the disease than the influence of the drug. Among the patients suffering from chronic gout it will be seen that in Case 11, colchicum was administered with the apparent effect of diminishing the excretion both of the uric acid and urea.

From a general review of the results obtained in the preceding analyses, we are compelled to draw the following conclusions.

First. There is no evidence that colchicum produces any of its effects upon the system by causing the kidneys to eliminate an increased quantity of uric acid; in fact, when the use of the drug is continued for any lengthened time, it appears to exert a contrary effect.

Secondly. That from the observations above detailed, we cannot assert that colchicum has any influence upon the excretion of urea, or the remaining solid portion of the urine.

Thirdly. That colchicum by no means acts in all cases as a diuretic, but, on the contrary, it often diminishes the quantity of urine, especially when it produces a marked effect upon the secretions from the alimentary canal.

Dr. Christison's observations would probably have agreed with many of my own, had I taken for analysis portions only of the daily urine, for Case 2 might have been made to show that the uric acid was more than doubled by the remedy, although in reality there was no increase in the daily elimination. I am therefore inclined to think, that when the uric acid has been stated to have been augmented by the administration of colchicum, such has arisen either from the disease having become altered in phase during the examinations, as probably occurred in Chelius' case, or that erroneous deductions have been drawn from analyses of only portions of the daily urine.

As the operation of colchicum can neither be explained by its purgative effects, nor by its power of altering the character of the blood and urine, its real mode of action is still a subject for inquiry, and well worthy of occupying the attention of the therapeutist. Some have suggested that it may act on the nervous system as a sedative, but such an explanation is of so general a character that it applies to many drugs besides colchicum. Others have imagined that its power is due to the influence which it exerts on the peculiar structures implicated in gouty inflammation, namely the ligamentous and cartilaginous tissues. This may possibly be correct, for we know that certain sedatives control the heart, or central organ of the circulating system, others, the capillaries or extreme portions; and it may be that those tissues, of which the vitality is low, are peculiarly affected by the drug in question. Should this be so, we should expect to find that inflammation, other than gouty, of the same tissues is controllable by means of colchicum; and again, that gouty symptoms, unconnected with such inflammation, are not so influenced; but before the subject can be considered definitely settled, the test of much further clinical experience is needed. It is true that there are many obstacles in the inquiry, and not the least is the difficulty of positively ascertaining if the affected tissues are alike in our comparative trials.

Although colchicum may possess some power over rheumatic inflammation, it assuredly does not exert the specific action that is exhibited in cases of true gout, but here it may be argued that the structures affected in the two diseases are not precisely the same.

Lastly. It is asserted by some that colchicum possesses the power of rendering the urine neutral, or even alkaline: that such is not an invariable effect my own observations prove, but as they were all made on the whole day's urine, and as changes rapidly ensue in the fluid after its secretion, the amount of this influence was not ascertained.

Without at present attempting to explain satisfactorily how colchicum acts in controlling gouty inflammation, that it does so in a most marked degree is a fact placed beyond all doubt by the evidence already adduced, and could be strengthened, if necessary, by further proof, especially by the circumstance that sufferers from gout often take colchicum, not only without consulting their medical advisers, but even contrary to their injunctions, which alone clearly proves that the remedy is possessed of considerable powers.

The great popularity of the different quack preparations, such as the Eau Médicinale, Wilson's Tincture, and Reynolds' Specific, all of which owe their efficacy to the colchicum they contain, point to the same conclusion; and I believe we may safely assert, that colchicum possesses as specific a control over true gouty inflammation as cinchona barks over intermittent diseases. But the evidence hitherto adduced of the power of colchicum in alleviating the urgent symptoms of gout, has not in any way shown that it may not prove injurious in its after-effects, and the determination of this point is fraught with interest. Sir C. Scudamore, in alluding to the Eau Médicinale, of which he often witnessed the effects, remarked that it had been the fruitful source of many cases of chronic gout, by enfeebling the nervous system, and occasioning a degree of despondency and languor never before experienced; and he furthermore asserted, that he had found no cases of gout so tedious and intractable as those which had been thus empirically treated.

Notwithstanding these remarks with regard to the Eau Médicinale, Sir C. Scudamore was in the constant habit of prescribing preparations of colchicum, and in another passage stated, that he considered it must be admitted to be a valuable medicine by all who had sufficient opportunity of putting its merits to the test.

Other physicians have expressed themselves somewhat strongly on the same subject, for example, Dr. Petit had an idea that colchicum causes gouty attacks to become more frequent and chronic, and Dr. Todd in his clinical lectures expresses a similar opinion, for he remarks, that although colchicum shortens the duration of the fits, it also diminishes the interval between the attacks, and that the system gets accustomed to its use as it does to opium, and, therefore, the dose must be increased to keep up the effect. It is curious to find that Paulus Ægineta in reference to the use of hermodactylus in gout says, that although it generally removes the symptoms within two days, it injures the stomach and creates loss of appetite, and should, therefore, be used only by those who are engaged in business which cannot be deferred.

In antagonism to these authorities, there are many physicians of the highest eminence who regard colchicum as a remedy of the utmost value in the treatment of almost all the different manifestations of gout; among these I may mention Dr. Watson, who, in his Lectures on the Practice of Physic expresses himself very decidedly on the subject. With regard to the acute paroxysm, he remarks that colchicum, judiciously given, may be fairly accounted a specific; and again, "This drug has certainly the property of easing, in an almost magical manner, the pain of gout. How it operates is not so clear. It is apt to produce nausea, faintness, and diarrhœa; but its curative influence is not conditional upon the occurrence of these symptoms. Sometimes the rapid disappearance of the gouty inflammation is its only perceptible effect. The patient may be in helpless agony with a tumefied red hot joint, to-day; and walking about, quite well, to-morrow. The colchicum is, therefore, plainly an anodyne." And as to its use in the more chronic forms, the same author observes, "I apprehend the proper way to eradicate the lurking residue of the mischief is to continue to give small doses of the colchicum; five minims of the wine, for instance, two or three times a day for a while." And lastly, that he looks upon its proper use in the intervals as likely to be attended with beneficial effects, will be evident from the following passage:—"And as I think that the dregs, if I may so speak, left behind it by a gouty paroxysm, may be dispersed by the continued use of what, in the usual acceptation of the word, I may call alterative doses of colchicum (doses, that is, which produce the desired purpose gradually, and by insensible operation), so I think it probable that many a fit of the gout might be averted, if the remedy were given in the same way upon the first occurrence of the ordinary premonitory troubles."

Although I confess that a still more searching investigation, not only of the mode in which the action of colchicum is produced, but likewise as to the real effects of the remedy under different circumstances, is still a desideratum, and one, I trust, to be enabled one day to unravel—still, as the result of long-continued observation, I am of opinion that the following propositions can be established and may be acted upon with safety.

First, in acute gout.—Colchicum has a specific power over true gouty articular inflammation, and may be given with advantage under such circumstances. It seldom fails to allay inflammatory symptoms in a short time, without the production of any sensible physiological effect.

If cathartic action be required in gouty cases, it is better to combine the colchicum with some aperient, and not trust to the influence of the former drug to produce it, as when much purging and vomiting results from colchicum, nervous and vascular depression likewise follows.

It is of advantage to give a full dose of colchicum at first, half a drachm to a drachm of the wine, and follow it up by much smaller doses, as from ten to twenty minims two or three times a day, carefully watching its effects on the pulse, and never allowing sickness or depression to ensue.

Colchicum when injudiciously administered, gives rise not only to nausea and vomiting and extreme depression, but occasionally to a very obstinate and peculiar kind of diarrhœa.

When great depression is produced, gout is apt to recur soon after the patient rallies from the effects of the drug.

The influence of colchicum in acute gouty cases should be continued in a mild and gradually diminishing degree for several days after the inflammation has subsided.

When colchicum is carefully prescribed, it has no tendency to prolong the gouty paroxysm or render the disease more chronic in its character.

Secondly, in chronic forms of gout.—Colchicum may be advantageously used in the exacerbations, but with great moderation, as its use is less called for to alleviate pain, and the patient is generally less able to bear any depressing effect; at the same time, it must be remembered that patients who have taken colchicum for a lengthened period acquire a certain tolerance of the drug, a circumstance to be considered in apportioning the dose.

Thirdly, in the intervals between attacks of gout.—There is some evidence and considerable authority for regarding the use of colchicum as valuable in warding off an attack, especially when an approaching fit is beginning to manifest itself; but the premonitory symptoms may be due to the commencement of gouty inflammation, and would then be relieved by the administration of the drug.

Colchicum may often be given with advantage to gouty subjects as a cholagogue in lieu of the preparations of mercury.

Value of different preparations of Colchicum.—The last question in relation to colchicum that requires discussion refers to the preparation best suited for employment, and upon this subject it is well that a few observations should be made. Whether the power of colchicum be due to its containing an alkaloid, as stated by Geiger and Hesse, or a neutral crystalline body, according to Oberlin, it is a matter of the highest probability that the same active principle pervades the whole plant, though in different degrees; so that whether the powdered corm, or the wine, or extracts of the same, or the tincture of the seeds, or lastly the flowers be made use of, the very same remedy is virtually administered to the patient. The truth of this statement being established, much of the discussion which has arisen regarding the relative virtues of the different preparations of the plant, although of high importance to the pharmacopolist, possess but little interest to the therapeutist. It will be found, in watching the practice of those best able to judge of the effects of remedies, that one physician employs a preparation of the corm, another of the seeds, and a third of the flowers, each being fully satisfied with the effects obtained from them; although it is true that some of the preparations are more powerful, dose for dose, than others, yet the difference is easily explained from the quantities of the drug made use of in their formation, as well as the varying strengths of the parts of the plant employed.

I have frequently prescribed an amorphous form of *colchicia* obtained from Germany with good and uniform effect, and the dose which has been found to answer has varied in different subjects from a thirtieth to a fifteenth of a grain, which may be dissolved either in water or some aromatic vehicle. The only objection to its use is the absence of crystallisation; and I should feel much interest in substituting M. Oberlin's crystalline neutral principle, which, as indicated by chemical tests, is contained in the amorphous colchicia. By the use of such a preparation we should feel assured that we were prescribing the drug in definite doses, without fear of its activity being influenced by season, soil, or other circumstances which necessarily cause considerable alteration in the strength of the galenical compounds.

The preparations of colchicum I have been most in the habit of employing are the wine and the acetic extract of the corm; the first is an advantageous form when the medicine is given as a draught, the second when required to give it as a pill.

I am fully persuaded that all the good effects derivable from the plant can be obtained from these two preparations, still others may sometimes be advantageously prescribed, as the vinegar of colchicum, the tincture of the seeds, and the ammoniated tincture; the latter is useful when it is desirable to give likewise a vascular stimulant as in cases where much depression exists.

Most of these preparations have had their advocates; the acetic extract was introduced and favourably reported upon by Sir C. Scudamore, who considered it milder in its action than other forms, and that the acetic acid exerted a modifying power over the active principle. The simple extract was the preparation of Dr. Hue, and so on; but it may be regarded as a fact, that all the effects of the drug may be obtained by the proper administration of any one of its galenical forms; at the same time it must be borne in mind, that some are more active than others.

A mode of giving colchicum, commonly employed and answering more than one indication, is as a draught containing colchicum wine, the carbonate and sulphate of magnesia, and some aromatic water. By such a combination we produce not only the specific influence of the colchicum, but at the same time keep up the secretion of the bowels and kidneys, and augment the alkalinity of the fluids.

White Hellebore.—Veratrum album, or white hellebore, has been prepared and used in place of colchicum, and a preparation of it with opium has been proposed as a substitute for the celebrated Eau Médicinale. It is a plant which belongs to the same natural order as the colchicum, and the rhizome, the part employed, contains an alkaloid veratria, a principle occasionally employed as an external remedy. Veratria was formerly supposed to be identical with the active principle of the colchicum autumnale, and hence it was natural to suppose that hellebore might possess a like action. It has however been recently proved that veratria and colchicia are not identical, that the former is much more irritating than the latter, acting as a powerful sternutatory, and that it also differs from it in its chemical properties.

Sir C. Scudamore, who appears to have witnessed its effects, thought that it was too dangerous a medicine to be familiarly employed, and that it can seldom be given with prudence to gouty patients; that even in careful and graduated doses it often causes serious hypercatharsis, great depression of strength, spasms and burning pain in the bowels, cold sweats, and in some instances tremors, faintings, and the sensations of approaching death. I have had some opportunities of ascertaining the value of the white hellebore and also of the alkaloid veratria in the treatment of gout, but in the cases which have come under my own observation, the drugs were given with much care, and in doses incapable of producing injurious effects. The following case will illustrate its action :—

June 18, 1854. A patient 50 years of age, who had long suffered from gout, and had deposits of chalk and much distortion of the joints, was attacked at the above date with a severe fit; there was swelling and pain of both feet and right hand, and many of the smaller joints of the left hand and the elbows were more or less implicated. Pulse, 96; thirst. Ordered to take at 5 p.m. a draught containing $\frac{1}{16}$ grain of veratria dissolved in an ounce of water with a few drops of spirit.

The draught produced some slight nausea, but no other symptoms; at 10 p.m., $\frac{1}{12}$ grain of veratria was given, vomiting of a dark-coloured matter took place during the night, and the bowels, previously much confined, were relieved, partly perhaps by the veratria, but he had previously taken an ordinary senna draught.

June 19. Patient feels easier in all joints, but especially in left hand. Pulse 72, not full or hard; thinks he became relieved after the veratria. Ordered to take $\frac{1}{16}$ grain of veratria at 4 p.m.

June 20. Has taken three doses of veratria, no feeling of sickness, but a cup of tea has been vomited; many of the joints much more painful. Pulse 84, fuller. To take $\frac{1}{8}$ grain of veratria three times a day.

June 22. After taking three doses of the medicine, felt intense thirst, burning and dryness of the mouth, but no purging or vomiting; the joints were worse than before. Since omitting the medicine, less thirst and dryness of the mouth and throat. Bowels open to-day from a dose of house medicine.

The patient was then ordered a colchicum mixture, and after having taken it for 24 hours, the joints were greatly relieved.

From this case, it is evident that the veratria, although carried to the extent of producing disagreeable thirst and dryness of the mouth, was attended with no real alleviation of the gouty symptoms; the slight improvement at first experienced probably arose from the relief of the bowels, but the colchicum, without the production of either thirst or dryness, rapidly removed the articular disease.

I have witnessed the administration of the wine of hellebore with a similar result; it produced a burning sensation of the œsophagus, parched mouth, and intense thirst, accompanied by great depression, but without alleviating the gouty symptoms.

The difference between the active principles of colchicum and hellebore is also well exemplified by the following experiments made by MM. Geiger and Hesse:—

$\frac{1}{10}$ of a grain of *Colchicia* dissolved in weak alcohol was given to a cat eight weeks old; much foam almost immediately appeared at the mouth; at the end of about an hour there were abundant liquid dejections, followed, after an interval, by vomiting. The gait of the animal became staggering, it fell, rolled from side to side, uttered a plaintive cry, and appeared agitated by convulsive movements. These symptoms gradually augmented, and death took place in 12 hours. On opening the body, the stomach and intestinal canal were found intensely inflamed and congested throughout. A $\frac{1}{20}$ grain only of *veratria* given to a younger cat, caused the animal to stagger more convulsively, and die in 10 minutes, after death, no inflammation was found, except at the inferior part of the œsophagus, a portion of the canal not inflamed in the cat poisoned by the colchicia. In most of the fatal cases of poisoning by colchicum, the same inflamed condition of the mucous membrane of the alimentary canal has been observed.

I think, therefore, we may conclude, that although white hellebore belongs to the same natural order as the colchicum autumnale, its physiological and therapeutic properties are by no means the same, and that it is not a desirable remedy in the treatment of gout.

CHAPTER XII.

TREATMENT OF GOUT :—ITS IMPORTANCE IN THE CHRONIC STAGES OF THE DISORDER—MEDICINAL TREATMENT OF CHRONIC GOUT—GENERAL SKETCH OF—VALUE OF SPECIAL REMEDIES—ALKALIES AND SALINES—DILUENTS—LITHIA SALTS PROPOSED AS CURATIVE AGENTS—THEIR SPECIAL ACTION AND ADVANTAGES—ASH LEAVES IN GOUT—TONICS—THEIR VALUE IN GOUTY CASES—PORTLAND POWDER—DISCUSSION OF THE LIABILITY OF TONICS TO PRODUCE INJURIOUS CONSEQUENCES—TREATMENT OF THE LOCAL AFFECTIONS—EDEMA—STIFFNESS OF JOINTS—CHALK-STONES—GOUTY ABSCESSES—DIET AND REGIMEN IN CHRONIC GOUT—THE PROPHYLACTIC MANAGEMENT OF GOUT.

WHEN gout, instead of passing off in the course of a short time as an acute fit, lurks about the joints, now attacking one, now another, with moderate intensity, but with the production of much stiffening and distortion, it has assumed a form to which the term chronic gout may be properly applied, and one which requires a considerably modified treatment to that which we recommended for its genuine acute attacks. If it be necessary in acute gout to make the treatment dependent in some measure upon the peculiar state of the system, or idiosyncracy of the patient, it becomes a matter of much greater moment to attend to these various circumstances in prescribing for the chronic forms ; for a treatment, which in one case would be attended with essential advantage, in another might prove not only useless, but positively injurious. Such differences depend not only on the constitutional peculiarity of the subject in which the disease occurs, but likewise on the form which it assumes. In one patient we may find that the development of the gouty symptoms is intimately associated with the state of the skin; in another, with the condition of the stomach and its appendages; in a large class of cases, a greatly augmented formation of uric acid is the chief cause of the malady, whereas in a smaller class, deficient excretion of this principle by the kidneys may be the most important element of the disorder. All these considerations must be taken into account in successfully prescribing for the disease in question, and although a general outline of the plan of treatment is capable of being delineated, still the deviations from it are necessarily numerous, and must be left to the judgment and acumen of the practitioner.

As we have before had occasion to remark, in our last chapter, the use of colchicum in the early attacks of gout has been accused of inducing this chronic condition, but that such antecedent treatment is not essential, I can from my own experience affirm, having recently met with a well marked instance to the contrary in a patient who had experienced attacks of the disease for about fifteen years, but had never had recourse to the use of medicines. In this case, the attacks were at first short, and the intervals between them long; but within the last five years their frequency has greatly increased, the duration much prolonged, and the disease has assumed a chronic form, accompanied with visible deposits, thus proving that there is a natural tendency in gout, when uninfluenced by remedies, to assume a more severe and obstinate character.

We will first speak of the medicinal treatment of this variety of gout, postponing the consideration of diet until the latter portion of the chapter, when we shall not only include the management requisite during the period of the chronic inflammatory action, but likewise the prophylactic regimen necessary to be pursued to prolong the intervals of the attacks, or altogether prevent their return. In treating of the value of medicines, the same remarks will in some measure apply, as chronic gout consists merely in a succession of oft-repeated sub-acute paroxysms.

Although due attention to the inflammation of the joints in this variety of gout must not be lost sight of, still the constitutional treatment must now have especial reference to the morbid condition of the blood, and be directed towards removing the impurities with which it is charged; an object best effected by augmenting the activity of the secreting organs, especially the kidneys and skin, by altering the composition of the fluids, and rendering the abnormal matter less injurious, and above all, by obviating the circumstances which lead to the production of the disease.

With regard to the direct treatment of the inflammatory state of the joints, this can often be successfully effected by the administration of colchicum for a while, in very minute doses, carefully avoiding depression, and using the precautions detailed in the last chapter; but in some cases other remedies are required, and iodide of potassium and guaiacum may frequently be had recourse to with advantage. It must be remembered, that in chronic gout, a low form of inflammation may be kept up by the presence of old deposited matter, and altogether independent of the specific form of action constituting true gouty inflammation; it is particularly in these cases that the remedies alluded to prove most beneficial. Iodide of potassium has undoubtedly a marked power in alleviating other affections of the fibrous tissues, as seen in the relief afforded in nodes; and in many cases of gout, especially where the inflammation assumes the character known by the name rheumatic, this remedy is of great benefit, acting on the fibrous tissues, and tending to remove the remnants of the inflammation. In sub-acute forms of rheumatism iodide of potassium is peculiarly indicated when the pains are increased by warmth, and the same indication may be taken as a guide in chronic gout.

I do not consider that this salt possesses any appreciable power in removing the deposits of urate of soda, but nevertheless look upon it as a valuable agent in the cases above referred to. Mr. Spencer Wells states that he has employed the iodide with much advantage when joints have been enlarged, stiffened, and rendered painful by the presence of gouty deposits. The dose of the iodide of potassium necessary to effect all the good results of the remedy need not be large; from half a grain to a grain, twice or three times a day, taken in water, or in combination with certain other salines which will shortly be mentioned.

Guaiacum may likewise be employed for the sake of its action on the fibrous tissues, and may be given in chronic forms of gout when the circulation is languid and the painful parts are relieved by the application of warmth. I have found great benefit in many such instances from this drug, and it is a remedy which may be administered without mischief, for any ill effects, as nausea or purging which occasionally result, are at once made manifest both to the physician and patient. Guaiacum may be given either in the form of the mixture of the Pharmacopœia, or as the simple or compound tincture, the ammonia contained in the latter being often beneficial, as it augments the stimulant action of the guaiacum upon the vascular system; but when active inflammatory symptoms exist, or when warmth increases the pain, as a rule, the use of guaiacum is contra-indicated; cases now and then occur in which it may be combined with advantage with iodide of potassium. Other stimulant remedies, as mezereon and serpentaria, may be given to fulfil the same indications as guaiacum, either in the form of the simple decoction, or infusion, or as the compound decoction of sarsaparilla, which unites the virtues of all these drugs as well as that of the sarsaparilla itself, and is a convenient method of exhibiting them. Sulphur has likewise been occasionally prescribed with the same view.

To remove the abnormal state of the blood which invariably exists in chronic gout, and endeavour to restore the circulating fluid to a state of purity, must be our next object. It will be remembered that the presence of urate of soda in the blood has been shown to depend on two causes; first, its undue formation from some form of dyspepsia or mal-assimilation, secondly, its deficient excretion from the renal organs. These causes are usually found combined, but in some subjects the first is most prominent, in others, the second, and consequently our treatment must be considerably modified in different cases. The undue formation of uric acid will be found to be especially influenced by diet and regimen, whereas the deficient excretion is more under the control of remedial agents; upon the latter we shall first discourse: but previously to so doing, I cannot help alluding to Sydenham's advice with regard to the treatment of gout, in which he remarks, that remedies, to be of service, must be steadily and perseveringly adhered to, and not merely taken by the bye; that a change of the whole system is required which no sensible man can believe is possible to be effected in a short time: he then goes on to say, "For years together a man has drunk and feasted—has omitted his usual exercise—has grown slow and sluggish—has been over studious or over anxious,—in short, has gone wrong in some important point of life. In this case he has, as it were, taken trouble to pervert the various ferments of the body, and to smother the animal spirits, which are the primary instruments of concoction. Hence the humours preternaturally accumulated, break forth, after having become exalted in the highest degree. They destroy the system. The muscles are softened and the joints relaxed, so that the affluent humours are readily received. A new nature is now superinduced, the original and natural economy of the body being altogether broken up and destroyed. The fits that seem so important in the eyes of the party, are nothing more than the series and order of symptoms which nature uses in the expulsion of the morbific matters. Hence, to use any medicines for a time is a waste of labour. The weakness of all the digestions, and the loss of natural strength in the several parts, are the essence of gout. Each must be dealt with."

The remedies best adapted to purify the blood are those which increase the activity of the secreting organs, more especially the kidneys, as also such as possess the power of rendering the presence of the urate of soda less injurious by preventing its further deposition in the tissues, or even removing it when already infiltrated. To effect these purposes alkalies and salines are peculiarly called for, and many of them are of sufficient importance to demand a special inquiry into their nature and mode of action.

Alkalies and *Salines.*—Alkalies and salines have long enjoyed much reputation in the treatment of chronic gout ; Boerhaave and Hoffmann recommended them to be taken in small and frequently repeated doses for a long while, and for this purpose employed the ashes of different plants, burnt either to blackness or whiteness; for example, broom ashes dissolved either in water or Rhenish wine: they also used the alkaline earths for the same purpose. Cullen remarks that, when some fixed alkali either in a mild or caustic state, or lime-water, soap or absorbent earths, have been given in nephritic or calculous cases, to patients who were at the same time subject to gout, it has been observed that, under the use of these medicines, they have been longer free from the fits of the latter disease. He adds, that he does not know, if when very long continued, they would prevent the returns of gout, as he had never ventured to give them for so long a period, fearful of producing a hurtful change in the blood. Dr. Wollaston, in alluding to his discovery of the real nature of gouty chalk-stones, and in reference to the opinion just quoted, says, "The knowledge of this compound may lead to further trial of the alkalies, which have been observed by Dr. Cullen to be apparently efficacious in preventing the returns of this disease; and may induce us, when correcting the acidity to which gouty persons are frequently subject, to employ the fixed alkalies, which are either of them capable of dissolving gouty matter, in preference to the earths, which can have no such beneficial effect."

Magnesia and lime as well as the fixed alkalies have, nevertheless, been recommended in gout, and cases are on record in which the attacks appear to have been kept off for some time by steady perseverance in their exhibition. On the other hand, some physicians have had no confidence in the administration of alkalies; but it will be found, that the opponents as well as the partisans for these remedies, have been considerably biassed by their respective ideas of the nature of the disorder; upon the whole, the recorded facts are in favour of benefit having been derived from their use.

In my remarks on the value of alkaline remedies, I shall include not only the alkalies and their carbonates, but also such neutral salts as the citrates and tartrates, which are decomposed in the blood, and render the urine less acid in reaction; and, in addition to these, I shall speak of certain saline substances, as the phosphate of soda and phosphate of ammonia, which exert a specific action upon the renal and cutaneous secretions; but before entering at length into the value of these remedies, it will be advisable to say a few words with regard to the difference of action which they respectively exert.

It must be remembered that when caustic potash and soda are administered, in the form of liquor potassæ or liquor sodæ, the amount of the alkali capable of being introduced into the system is exceedingly minute, and its influence is probably exerted chiefly upon the mucous membrane of the stomach and its contents, and therefore acts simply as a direct antacid and local sedative, the alkali absorbed being insufficient to render the urine either neutral or alkaline. But when the carbonates and bicarbonates of these alkalies are given, so much of the salts may be introduced as not only to neutralise the acidity of the alimentary canal, but to render the blood more alkaline, and notably alter the secretion of the kidneys, and this effect is more especially observed after doses of the bicarbonates.

The same is observed when the common phosphate of soda is employed; a salt which possesses an alkaline reaction and passes through the system apparently unchanged.

In the case of the citrate and tartrates of the alkalies the effect is different. These salts are neutral, and have no power of neutralising acid in the stomach; but after their absorption into the blood, they are decomposed by the oxidation of the acid contained in them, and afterwards thrown out by the kidneys in the form of the carbonates or rather bicarbonates of the respective alkalies.

As yet we have spoken of potash and soda salts as exerting the same influence, but this is only correct up to a certain point, beyond which a difference of effect is distinguishable. Looked upon physiologically, potash salts act more especially upon the kidneys and induce powerful diuresis; soda salts influence the liver more than potash salts, but act less upon the kidneys; and in a chemico-physiological point of view, the uric acid of the blood and urine is rendered much more soluble by the potash salts than by the corresponding salts of soda.

The influence of the potash salts as diuretics is well shown in some experiments of Professor C. G. Mitscherlich of Berlin, recorded in his Lehrbuch der Arzneimittellehre. This physician gave to a man suffering from prolapsus vesicæ, half drachm doses of carbonate of potash dissolved in six ounces of water. In half an hour the urine became neutral and in 38 minutes alkaline. The quantities of urine which were secreted in each 20 minutes were as follow, measured in cubic centimeters:—

After the first	20	minutes	32	cubic cent.—	sp. gr.	1020
After the second	20	,,	49	,,	,,	1014
After the third	20	,,	75	,,	,,	1009
After the fourth	20	,,	50	,,	,,	1014
After the fifth	20	,,	30	,,	,,	1018

The total quantity in one hour and 40 minutes being 236, or a little more than eight ounces. The same patient when not under the influence of the drug, passed, on an average, less than two ounces in the same time.

In another experiment the same man took 16 ounces of pure water, and the urine passed is exhibited in the following table:—

After the first	20	minutes	21	cubic cent.	—sp. gr.	1020
After the second	20	,,	26	,,	,,	1015
After the third	20	,,	51	,,	,,	1006
After the fourth	20	,,	56	,,	,,	1004·5

Thus showing that pure water, although it augments the secretion of the urine, is much less active as a diuretic than a far less quantity of a solution of bicarbonate of potash.

No observations of the action of soda salts upon the kidneys in comparison with the corresponding salts of potash are on record, although the fact of this difference in diuretic action is, I believe, generally admitted.

Potash and soda salts differ also very notably in their influence on the blood, and more especially in their power of imparting solubility to uric acid. This might be at once inferred from the greater solubility of urate of potash, and may likewise be observed in watching the effects of the two remedies in clearing the urine of patients from deposits of urates. The same fact may be illustrated experimentally; if, for example, small portions of gouty cartilage infiltrated with urate of soda, be placed in solutions of the carbonates of the two alkalies, it will be found that after the portion treated by the potash solution has become quite free from the urate, that immersed in the soda remains almost in its original state.

Having then established the influence of these salts in rendering the fluids of the body more alkaline, and in causing the solution of the uric acid, it becomes of importance to ascertain if the results of clinical experience accord with these facts. I should be inclined to lay great stress on Cullen's statement with regard to the therapeutic value of alkalies in the treatment of gout, because he was unfavourable to the idea of the disease being in any way connected with impurity of the blood, and makes the statement merely as derived from actual experience and in cases in which the alkalies were prescribed for a different purpose.

That alkaline remedies are useful in treating acute attacks of gout is a fact recognised by almost every physician, and their exhibition in such cases is extremely common; but it is a question of far more importance to determine whether, if their use be persevered in, they not only correct the condition of the blood, but likewise exert a beneficial influence over the progress of the disease. It may be well that I should give the result of my own experience upon this point.

First, in the treatment of the paroxysms or exacerbations of the joint affection, I am of opinion that alkaline remedies are of much value, and am constantly in the habit of prescribing them, either in the form of the bicarbonate of potash, or of the citrate or acetate of the same base. I prefer the potash to the soda salts, because the former possess the same alkaline properties as the latter, and have a greater solvent power for the uric acid, in addition to which the production of diuresis is attended with advantage.

In some instances in which magnesia is indicated, I have replaced the potash by this base, but only for a short time.

Next with regard to the continuance of the remedies when there is no inflammatory joint affection present. I am convinced from the results of many observations, that much benefit may be derived from a judicious administration of salines for a long period, and can bring forward evidence in support of my conviction; but to render them successful in such cases a particular form of exhibition should be adopted.

If a patient suffering from chronic gout be exempt from all active symptoms, the following considerations should guide us :

The salines should be given in small doses, and repeated two or three times a day.

They should be administered in a *very* dilute form, and always on an empty or nearly empty stomach, and some little while before food.

The nature of the salines should be dependent on the peculiarities of the case, and changed from time to time.

Small doses of saline matters are for many reasons preferable to large, when the continued employment of such remedies is desirable, as they produce no irritation or disturbance of the digestive organs, act more freely on the secretions, and are not liable to induce debility. The latter effect is occasionally seen if salines, and especially the alkalies, be given in considerable doses.

It is of much importance that the salines should be dissolved in a large quantity of liquid, and for this purpose I prescribe either plain or aërated water. The water itself is doubtless a powerful agent, and, if judiciously employed, of much service as a remedy; it is one perhaps too much neglected by physicians of the present day.

If water be given when the stomach is empty, it is rapidly absorbed into the blood by the veins, and quickly eliminated by the different secreting organs, whose functions are thereby greatly excited, and along with the augmented watery secretion, matters which would otherwise be retained, are thrown out, and the blood rendered purer. I have reason to believe that the increased excretion from any organ is always attended with an increase not only of the watery portion, but likewise of the solid matter of such excretion; that when, for example, diuresis is induced by any means, more of the peculiar ingredients of this fluid are at the same time eliminated, and that no such difference exists between diuretics as has been asserted, namely that one class merely augments the watery portion of the urine, the other the organic and inorganic solids likewise. We have evidence of the value of water as an active medicinal agent in the fact that mineral waters holding in solution varying amounts of saline matters, and also salts of very different characters, act equally efficaciously in relieving the same disease; a circumstance probably depending on the powerful influence of the water itself.

The reason dilute saline solutions should be taken on an empty stomach is from their liability to produce dyspepsia if otherwise administered; water itself will cause indigestion if taken soon after a meal, and this tendency to disturb the stomach will be further increased if a saline, especially an alkali, be dissolved in it.

The choice of the saline is a point of some importance. I am inclined to regard almost all salines as beneficial, but some are more adapted to particular cases than others. When the function of the skin is imperfectly performed, the salts of ammonia are peculiarly indicated, and the phosphate may be employed with advantage; it possesses also some considerable solvent power for urate of soda, and there is much clinical evidence to prove its value in the treatment of chronic gout. It was first introduced as a remedy for this disorder by Dr. Buckler, of Baltimore, and since that period has been employed by several physicians with success.

If there be a deficient secretion from the kidneys, the salts of potash are desirable, on account of their diuretic properties; added to which they possess, as before stated, great solvent powers for urate of soda; and I am fully convinced that this latter property must play a most important part in the therapeutic action of the drug.

The phosphates of potash are not much used, for the salt which corresponds to the common phosphate of soda is not one which is pharmaceutically convenient to administer.

The citrate of potash is also valuable, and produces no disturbance of the stomach; it is agreeable to the taste, useful when a direct antacid is not required, and may be advantageously given in the effervescing form. The acetate is less pleasant, but an efficacious salt. The tartrate is not desirable in the majority of cases from its liability to run off by the bowels.

The chloride of potassium may be occasionally prescribed as a diuretic and solvent; it is a normal constituent of the blood, although in much smaller proportion than the chloride of sodium.

Having frequently employed salines, as above described, I can speak most favourably of their value in chronic gout. I have repeatedly given them to patients who had for many years suffered annually from numerous severe attacks of the malady, with the effect of keeping them free from its return for a whole twelvemonth, and this exemption was accompanied with a decided improvement of the general health. Upon the whole, I have found no treatment so efficacious, and it is attended with this great advantage that it can scarcely be regarded in the light of drugging, as no really foreign body is thereby introduced into the economy, but merely a slight increase of those saline matters which are present in many articles of food, normal to the constitution of the blood, and even necessary to its healthy constitution.

In the case of a gentleman about 50 years of age, suffering from gout of long standing and much crippled with chalk-stones, this treatment proved so successful that he was able again to follow the enjoyment of shooting, from which he had been long debarred, and this marked improvement was in no way influenced by any very rigid adhesion to diet or regimen.

For such treatment to prove successful, it is important that it should not be used indiscriminately, but the cases properly selected; it would be inappropriate for those who are either greatly advanced in years, or whose kidneys are so injured and contracted that their power of eliminating even the watery portion of the urine has been much impaired; and lastly, it cannot be advantageously employed when the patient's stomach is unable to bear dilute saline solutions: for if a feeling of distension and weight, or other symptoms of dyspepsia, be induced, the treatment will probably do more harm than good. It sometimes happens that when the simple saline solution does not sit easily on the stomach, it may be made to do so by the addition of some aromatic bitter; and weak infusions of chamomile or ash-leaves may be substituted, either in whole or in part, for the water.

The salts of magnesia and lime may be used instead of the alkalies; their ordinary employment offers no special advantage, but on the other hand may be attended with discomfort; the first being liable to run off by the bowels, the latter to cause constipation. Instances, however, occur in which the administration of one or other may for a while prove serviceable ; in such the solution of the bi-carbonate of magnesia, or lime-water, may be had recourse to.

Lithia Salts in the Treatment of Gout.—On looking over the more recent analyses of several mineral waters, it will be observed that lithia is mentioned as occurring in minute traces, and not unfrequently, when no notice is taken of its presence, the omission has probably arisen from the analyst not having sought for it.

As the use of lithia in medicine is novel, it may be advisable to say a few words on its nature and properties, more especially as these salts may probably one day become important additions to the list of our materia medica.

Lithia was first discovered by Arfwedson, in 1817, in the mineral Petalite, and was so named from λίθειος, stone-like. It has been extracted from several other minerals, and has been found in many medicinal springs, as those of Carlsbad, Aix-la-Chapelle, Marienbad, Kissengen, Ems, Teplitz, Bilin, Kreuznach, Vichy, &c.

The metal lithium, of which lithia is the oxide, is of a beautiful white colour, not unlike silver, readily oxidised by exposure to the air, of a specific gravity much less than that of water, in fact lighter than any known liquid. It is also remarkable from possessing a very low atomic or combining proportion, not exceeding seven on the hydrogen scale.

Lithia forms the third fixed alkali, and occurs as a white crystalline substance, with a caustic taste, and possessing an intense alkaline re-action, similar to potash or soda. In some of its chemical characters it closely approaches these bases, in others magnesia and lime. The proto-carbonate differs from the other alkaline carbonates in being little soluble in water, requiring about 100 parts, but when dissolved in even 1000 parts the solution is alkaline: with excess of carbonic acid it is rendered more soluble.

The taste of carbonate of lithia closely resembles that of bicarbonate of soda. As the equivalent of lithium is small, it follows that both the alkali and the carbonate possess great neutralising powers for acids, and in this respect differ from the corresponding preparations of the other fixed alkalies.

One of the most remarkable properties of lithia is its power of imparting solubility to uric acid, the urate of this base being the most soluble of urates. It has been found by Lipowitz, that when the mineral lepidolite is reduced to powder and boiled with uric acid, so great is the affinity of the acid for this base, that urate of lithia is formed, although the alkali was previously combined with silicic acid.

I have also found, that when carbonate of lithia in excess is boiled with water, the addition of uric acid causes it to dissolve, showing that the urate of the base is more soluble than the carbonate itself. The salt formed under such circumstances is the bi-urate of lithia, which crystallises in long needles, and corresponds to the salt of soda found in the blood and tissues of gouty subjects.

This salt is much more soluble in water than any other urate, but to what extent has not been accurately determined. Lipowitz discovered that one part of carbonate of lithia in 90 parts of water, at a boiling heat, dissolved 4 parts of uric acid, with the evolution of carbonic acid gas, and the salt so formed, when free from any carbonate, dissolved in 60 parts of water.

Mr. A. Ure found that a solution of one grain of carbonate of lithia in an ounce of distilled water, when raised to the temperature of 90° Fahr., and uric acid gradually added in minute portions until it ceased to dissolve, took up 2·3 grains, a quantity much larger than that dissolved by either carbonate of soda or carbonate of potash; and Binswanger ascertained that 1 part of carbonate of lithia in 120 parts of water, dissolved at a blood heat nearly 4 parts of uric acid.

To show the power of carbonate of lithia in rendering urate of soda soluble, I made the following experiment:—A metacarpal bone was selected, the phalangeal extremity of which was completely infiltrated with gouty deposit. This was placed in a small glass, and a few grains of carbonate of lithia added, without the application of heat; in the course of two or three days, when the head of the bone was examined, no deposit could be seen, and the cartilage appeared to be restored to its normal state.

The lithia salts can scarcely be said to have been employed therapeutically until recently by myself in the treatment of uric acid gravel, and chronic gouty conditions of the habit. Mr. A. Ure had proposed the use of the carbonate as an injection into the bladder, for the purpose of dissolving calculi; and in a paper published in the "Pharmaceutical Journal," August, 1843, gives an account of an experiment in which he found that a human urinary calculus, composed of uric acid with alternate layers of oxalate of lime, when placed in a solution of four grains of carbonate of lithia in an ounce of distilled water, and steadily maintained at a blood heat during five consecutive hours, lost five grains in weight. The difficulty of procuring the salt prevented his pursuing further inquiries upon its action as a solvent for vesical calculi. Nothing appeared to be known as to its internal employment; it was conjectured by Dr. Pereira, from analogy, that it would render the urine alkaline, and it was asserted by Aschenbrenner that it might be given in doses of from five to ten grains daily.

Within the last two years I have made many trials of carbonate of lithia as an internal remedy, both in cases of uric acid diathesis connected with gravel, and likewise in several cases of chronic gout, and, from what I have experienced, am much satisfied with the results. When given internally in doses of from one to four grains dissolved in water, and repeated two or three times a day, it produces no direct physiological symptom, but exerts a marked influence in cases when patients are voiding uric gravel, causing the formation of the deposits to become less or cease altogether. In many instances in which I have administered it to gouty subjects, the result has been to diminish the frequency of the attacks, and altogether improve the condition of the patients. I am of opinion that the salts of lithia offer to the physician most valuable agents in these cases, as their alkalinising property is of the highest order, on account of the smallness of their atomic weight; and their solvent power for uric acid or urates, far greater than that of any other agent; in addition to which their local influence is slight, and their use does not appear to be attended with any injurious consequences.

To demonstrate the superior power of carbonate of lithia in removing the deposits of urate of soda from gouty cartilage, I performed the following experiment: solutions were made of the carbonates of lithia, potash, and soda, in the proportion of one grain of the dry salt to each fluid ounce of distilled water; into these were placed small pieces of cartilage completely infiltrated with urate deposit, which were allowed to remain for forty-eight hours. At the end of that time, the cartilage taken from the lithia solution was found to be restored to a natural condition; that from the potash was much acted upon, but that which had been submitted to the influence of the carbonate of soda appeared unaltered.

If the experiments be made with other salts of lithia, as the sulphate or chloride, in comparison with the corresponding salts of soda, the powerful influence of the former base will be at once apparent, for when sulphate of lithia in dilute solution comes in contact with urate of soda deposited in ligament or cartilage, double decomposition ensues, sulphate of soda and urate of lithia are formed, and the deposit is rendered soluble.

In administering the carbonate or any other salt of lithia, I have been guided by the following considerations:

They should be given freely diluted, either in the form of powder dissolved in a large quantity of water; or, which is preferable, dissolved in aërated water, so as to form *lithia-water* corresponding, except in strength, with the soda or potash-water in general use.

When a large amount of alkali is desirable, I have usually prescribed the carbonate of lithia with some salt of potash, as the carbonate or citrate, and the combination may advantageously be administered in the aërated state.

Carbonate of lithia can also be given with phosphate of ammonia in the same form; but it must be recollected that the phosphate, as well as the carbonate of this base, are very sparingly soluble in water. The great bar to the use of salts of lithia in medicine has hitherto been their expense, but in the small doses in which they are required, this need not be a serious objection, and moreover they can now be obtained at a much more moderate charge; it is probable that, should the benefit derived from their employment, in gouty cases, gravel and calculus—in which it is of importance to keep uric acid and urates in solution

—be equal to what may be reasonably anticipated, the supply of the drug might be greatly increased, and its cost proportionally diminished.

Fraxinus Excelsior, or, Common Ash.—Different parts of the Fraxinus Excelsior have at various times been employed in medicine; the bark was extensively used in the treatment of intermittent fevers before the introduction of cinchona into European practice; it was also employed in scrofulous and gouty affections, and intestinal worms. It is stated also, on the authority of Dr. Pouget, that the peasants of Auvergne have employed the leaves as a specific for gout for more than forty years.

M. Larue relates, that his mother was suffering in 1840 from a form of disease designated by him rheumatic gout; she had had it for two years, and it was gradually increasing in severity, accompanied with acute pain, much swelling, and great difficulty in moving the joints. After trying numerous plans of treatment without benefit, she was induced, on the recommendation of her milliner, to drink freely an infusion of ash-leaves. At the end of a fortnight she was relieved, and in a few months cured. M. Larue also states that in many other cases he had tried ash-leaves, and generally with complete success. The mode in which he gave the medicine was as a decoction of from 150 to 300 grains in about six ounces of water, and this quantity was taken night and morning, or every three hours, according to the intensity of the symptoms.

Drs. Pouget and Peyraud consider the leaves of the ash a true specific in the treatment of gout, and as not only possessing powerful curative properties, but devoid of all inconvenience and danger. As the result of a lengthened experience, they came to the conclusion, that within four or five days of their employment, the pains, redness, and swelling were generally diminished, and often completely cured, and they assert that if given for eight or ten days each month, the attacks can be warded off almost indefinitely.

The above statements were made in 1852, and the value of the leaves have been confirmed by a M. Mouchon.

I have made some trials of ash-leaves in acute and chronic gout, employing them in lieu of other remedies, so as to be able to ascertain their true value, and the following is the result of my experience. A gouty patient, about 55 years of age, with chalky deposits on several parts of the body, was seized with a fresh attack, April 24th, 1854; on the 27th of the month he came under my care, having swelling, heat, tenderness, and pitting of the left hand, and the small joints of the fingers and wrist; the left knee was also inflamed, and febrile symptoms were present. He was ordered at once to take five fluid ounces of the decoction of ash-leaves, (containing four ounces of the leaves in the ounce of decoction,) three times a day. On the 29th, having taken the medicine regularly for forty-eight hours, there was no alteration in the symptoms; the left elbow had become much inflamed, and the right ankle slightly so. Pulse 96, hard and full; much starting of limbs; furred tongue; some soreness of left ear, which was sprinkled with nodules of chalky matter; no sleep; bowels open from aperient medicine.

The medicine was then changed at patient's own request; as he stated that, from former experience, he was sure I could give him something which would relieve him. I ordered a colchicum mixture, and the gouty symptoms, within a few hours, were brought under complete control.

The second case resembles the first in many particulars. A man aged 38, who had suffered from gout for several years, and had a few spots of urate of soda on the palmar surface of one index finger, was next subjected to the treatment. The attack was becoming much more severe, and the day previous to his admission into the hospital the elbow had been severely inflamed, in addition to the joints previously affected. On the 27th of April he was ordered five fluid ounces of the decoction of ash-leaves, three times a day, which were taken regularly till the 2nd of May; it appeared to produce some nausea, but no purging, in other respects the patient remained the same, and the ash-leaves were consequently ordered to be discontinued, and half-drachm doses of vinum colchici substituted. After two days the inflammation of the joints had considerably subsided, and in a very short time the man was quite free from gout.

These cases gave me but little hope that ash-leaves were valuable in the treatment of the disease, and made me doubt the statements which had been made regarding them by Drs. Pouget and Peyraud; but, after administering the remedy in cases of chronic gout, I found reason to modify my views of their efficiency.

I have always given them in combination with a large amount of fluid, and am inclined to think that such a mode of administration has a powerful influence, as we have shown to be the case with different saline substances. I ordinarily prescribe them in the following way:—

An ounce of the leaves, as kept by the herbalist or druggist, should be boiled for ten or fifteen minutes in about two pints of water, and the decoction taken in divided doses during the day, generally about an hour before meals; its taste is by no means unpalatable, and several of my patients have drank it, instead of toast and water or other beverage; it is slightly bitter, and often appears to increase the appetite and improve the digestive functions.

If the ash-leaf tea do not displace to any considerable extent the other liquids taken during the day, diuresis or diaphoresis are induced; sometimes a slight action on the bowels, but ash-leaves given in this dilute form do not ordinarily produce any decided purgative effect. In illustration of their value, I may mention that I once ordered them for a gouty subject, who had many deposits upon the ears and hands, with great stiffness of many of the joints, and had for a long time annually suffered from five or six acute attacks of the disorder; by the aid of this medicine, he was kept free for more than a twelvemonth, and quite able to follow his usual occupation. He also recovered very considerably his power of walking, and is now able to take exercise to the extent of several miles.

In many other cases I have known good results to ensue, but few patients have persevered sufficiently long with the remedy.

As it may be troublesome to have the decoction daily prepared, I have sometimes ordered it in a concentrated form, so that the virtues of an ounce of leaves are contained in an ounce of the concentrated decoction, and from two to three tea-spoonfuls of this solution may be taken in eight or ten fluid ounces of water three times a day. A very small amount of spirit is required to preserve it for any length of time.

How ash-leaves act, I am quite unable to say. Do they produce more effect than an equal bulk of water? I believe the decoction sits more easily on the stomach than water, and this alone is a great desideratum. It appears also to act as a stomachic.

In the urine of the patient above alluded to, some difference in composition was noted, consisting in an increase of the uric acid, but unless this were confirmed by further experience, I should not be inclined to lay much stress upon it, as it might have arisen from other causes.

Stomachics and Tonics.—To prevent the undue formation of uric acid is equally as important as getting rid of it when present in the blood, and we must endeavour to effect this, if possible, by the adoption of proper measures. This object is chiefly obtained by strict attention to diet and regimen, but remedies directed to the restoration of the digestive organs are often of much importance, as we have seen that in the human subject an augmentation of this principle is intimately associated with certain forms of dyspepsia. When there is evidence of a congestive state of the liver, and other portions of the portal system, one must try to relieve it by unloading the turgid vessels and rendering the circulation more active. Mild alterative purgatives are then useful, combined with small doses of colchicum, to act as a cholagogue, or minute quantities of blue pill, or the same can often be effected by giving taraxacum freely, and keeping up its action for a while. Small doses of the neutral salts may be advantageous, combined with the last medicine, and if the patient be suffering from a form of irritative dyspepsia, solution of potash may be given, combined with a little dilute prussic acid. If, however, there is much want of tone in the stomach, bitters, and more especially those which are aromatic, may be either added to the other remedies or administered by themselves.

For this purpose, infusions of chamomile, calumba, chiretta, quassia, serpentaria, cascarilla, and other like substances are indicated, with the occasional addition of small quantities of the tinctures of ginger or capsicum, to give a little increased stimulus to the digestive organs; such infusions may, when advisable, be combined with bicarbonate of potash, carbonate of ammonia, or bicarbonate of soda.

When treating of the use of salines, we purposely omitted the consideration of the bicarbonate of soda, as it is a salt which possesses scarcely any solvent power over the urate of soda, and is, therefore, in this respect very inferior to the potash salt. Still there are cases in which bicarbonate of soda may be useful, as it agrees with the stomachs of some patients better than potash, added to which it seems to influence the secretion of the liver. I prescribe it in that form of gout which occurs in full habits, when the kidneys are but little implicated, and when the diathesis is strongly connected with derangement of the chylopoetic viscera. Where depositions of urate of soda are rapidly taking place in and around the structures of the joints, or near the external parts of the body, I believe the free exhibition of salts of soda likely to add to the mischief.

In connection with the treatment by bitter tonics, it will be well that we should allude to a once celebrated preparation, the Portland Powder, so named from its having been purchased by the second Duke of Portland, who, on account of the service it rendered him, distributed its recipe for general use. It consists of equal parts of the following five substances:—birthwort, gentian, germander, ground-pine, and the tops and leaves of the lesser centaury. The dose usually prescribed was a drachm, taken every morning fasting, for three months; after which it was reduced to three-quarters of a drachm, for another three months; then to half a drachm for the remainder of the year; after this the same dose every other morning for the next twelve months, by which time it was presumed a cure would be accomplished.

It must not, however, be supposed that this mode of combating the symptoms of chronic gout was by any means novel, for we find that very similar means were adopted by the ancients; thus Aetius, Galen, and others, were in the habit of employing bitters nearly akin with those composing the above powder, and Cælius Aurelianus even suspected they might do mischief. Sydenham likewise advises similar remedies, and gives a long list of plants which may be employed for the purpose, including among them angelica, elecampane, rue, chamomile, and juniper; many of them in their nature not unlike those before enumerated.

Heberden remarks, that this powder rose into favour too fast, and too high, to keep its place; but he thought that it had sunk into a state of discredit and neglect, as much below its real merit, as the first praises were above it. He was inclined to attribute this neglect partly to the largeness of its dose, which although almost too large for anybody, was indiscriminately given to all; and, lastly, by having all the natural ill effects of the gout attributed to it, particularly paralysis and apoplexy, symptoms probably due to the disease itself. Heberden states that during the great vogue of this medicine, the fit was so frequently found to be lessened, or to miss its usual time of coming after this remedy had been taken, that few can have any doubt, and he himself had none, of its having produced these effects; while its having any share in the mischief imputed to it, is devoid of certain proof, and in his opinion of much probability; and he further remarks, "Nor indeed was its disgrace owing to its doing too little, but to its doing too much. The dread of being cured of the gout was, and is still, much greater than the dread of having it; and the world seems agreed patiently to submit to this tyrant, lest a worse should come in its room." He considered that not less than fifteen grains should be given twice a-day, in a little simple peppermint-water, or common water, and that few would bear more than a two-scruple dose for a continuance.

The use of the Portland powder has been thought by some physicians to lead to much mischief; thus, Cullen states, that in every instance in which he had known it to be administered for the prescribed length of time, the persons who had taken it were afterwards free from inflammation of the joints, but became affected with many symptoms of the atonic form of gout, and all, soon after finishing their course of the medicine, were attacked with apoplexy, asthma, or dropsy, which proved fatal.

Dr. Cadogan likewise severely censured the use of the Portland powder, remarking that between fifty and sixty people that he knew who had been apparently cured by it for a little while, in less than six years had all died; but Dr. Mason Good, in commenting upon the opinion that bitters were mischievous in gouty subjects, makes the following very judicious remark: "As Dr. Cullen gives us no account of any mischief which has followed the use of bitter tonics in constitutions marked by general debility and atonic gout, the evils he has described seem on his own evidence to be limited to those whom we have already cautioned against the employment of such a course. No proper classification or line of distinction seems to have been drawn or adhered to, which would probably have presented us with very different results if it had been, and have superseded the clashing and unsatisfactory explanation of atonic effects uniformly produced by a continuance of tonic medicines."

I cannot conceive that the exhibition of aromatic bitters in proper cases can lead to the evil consequences alluded to by Cullen and Cadogan, but at the same time think that precaution should be used, and that they should only be given when circumstances are such as really call for their employment. The more potent tonics—as those which act on the nervous system, and especially the preparations of bark—have had their advocates for the treatment of chronic gout. Bark has been extravagantly lauded by some as a curative agent, but others have altogether condemned its employment. That it is not a specific, experience has assured me, and, moreover, it has often occurred to me to see remissions of the paroxysm follow its use:

but whether these were dependent on the bark, I cannot clearly assert. Sometimes I have given the medicine in the form of the decoction, sometimes as the sulphate of quinine.

There is one point of interest in relation to this subject, viz., that quinine has been stated by Dr. Ranke to diminish the secretion of uric acid in the urine; if this be the case, the diminution must depend either upon its lessening the formation of this acid in the system, or checking its excretion by the kidneys; if the latter be true, we should expect to find quinine and bark injurious in gouty cases, but if the former be the explanation, these drugs should prove of essential service. I have repeated Dr. Ranke's observations, but my results were not altogether in accordance with those obtained by him. There was, however, some difference in the mode of administering the sulphate of quinine; he gave only one large dose, about fifteen grains; I administered the salt in divided doses.

In one patient, a young man, recovering from a slight attack of colic, the amounts of uric acid eliminated by the kidneys under the full diet of the hospital and without medicine, during four days, were 5·04 grains, 7·44 grains, 6·86 grains and 9·22 grains. Three seven-grain doses of sulphate of quinine were then administered, and only 4·10 grains of uric acid were eliminated on that day; and on the following four days 7·68 grains, 7·70 grains, 6·53 grains, and 6·50 grains were secreted. For the next two days, six grains of the quinine salt were given three times each day, and the amounts of uric acid were 8·64 grains and 5·24 grains, and for the following three days, 5·85 grains, 6·84 grains, and 6·20 grains. It was only, then, on the first day that any sensible diminution in the secretion of uric acid occurred ; and if the average passed with and without the quinine be estimated, the figures will not be found to differ widely from each other.

In another case, a patient without medicine was passing 6·03 grains and 5·23 grains of uric acid on two consecutive days. When taking eighteen grains of sulphate of quinine in divided doses during three days, he threw out 5·58 grains, 5·76 grains, and 4·76 grains, and the next two days without the drug, 5·59 grains, and 6·69 grains of uric acid. The average without medicine being 5·89 grains, and when quinine was taken, 5·37 grains.

Dr. Ranke's skill as a physiologist, is so well established, and his experiments so decisive, that I should not wish for a moment to cast a doubt upon their accuracy, but would rather wait the result of further observation before forming an opinion on the subject. I cannot, however, help thinking that the decrease which occurs, is due rather to a sudden impression upon the nervous system causing the quinine to influence the excretion of uric acid, than to any deficient formation of this principle.

The last class of tonics we shall refer to are the ferruginous, or those having iron as their basis.

These preparations are very likely, when indiscriminately given to gouty subjects, to excite a paroxysm of the disease, and for the most part are contra-indicated; but cases of gout occasionally occur, accompanied with great want of tone and an anæmic state of habit in which their careful exhibition is attended with advantage. When iron is needed, a form of preparation should be selected which produces the least possible disturbance of the stomach. Cullen preferred the rust or oxide; those which I have found most beneficial are iron reduced by hydrogen, the *Fer reduit* of the French, or *Ferrum redactum* of the forthcoming British Pharmacopœia, or the saccharine carbonate of iron, or the carbonate dissolved in water with excess of carbonic acid. The citrate of iron combined with some of the salines already spoken of is likewise useful. Mineral waters of the ferruginous class, as those of Schwallbach, Spa, Pyrmont, may also be employed with advantage, as the large amount of water tends to keep the secretions free. During the exhibition of iron preparations, great attention should be paid to the condition of the bowels.

Treatment of the local affections.—We have already shown, in our third chapter, that chronic gout is often attended with much local mischief, which we there fully described. To such an extent does this sometimes proceed, that life may be made completely miserable. It is stated that in the case of the Emperor Galba, his hands and feet were so much distorted that he could neither wear a shoe, nor hold a small book; and he is reported to have said, "When I stand in need of eating I have no hands; when walking is necessary I have no feet; but when I am to be tormented, then feet and hands are all ready."

It has long been a prevailing opinion, not only among physicians, but the public also, that when chalky deposits appear on the surface of the body, or when the case is such as has been termed chalky gout, no cure can be expected. Hippocrates and Aretæus entertained this view, and Ovid has recorded the same in his epistle from Pontus, in which, as an apology for his mental distress being too strong for the advice and consolation of his friends, he says,—

> Non est in medico semper, relevetur ut æger;
> Interdum doctâ plus valet arte malum.
>
> Cernis ut e molli sanguis pulmone remissus
> Ad Stygias certo limite ducat aquas.
>
> Afferat ipse licet sacras Epidaurius herbas,
> Sanabit nullâ vulnera cordis ope.
> *Tollere nodosam nescit medicina podagram,*
> Nec formidatis auxiliatur aquis.

And in proof that even at no very distant period the same opinion was held, we find Horace Walpole, himself a sufferer from chalky gout, saying in one of his letters: "I have so good an opinion of the gout, that when I am told of an infallible cure, I laugh the proposal to scorn, and declare I do not desire to be cured. I am serious; and though I do not believe there is any cure for that distemper, I should say the same if there were one, and for this reason, I believe the gout a remedy, not a disease, and being so, no wonder there is no medicine for it—nor do I desire to be cured of a remedy."

As the physician is often consulted by patients suffering from the consequences of chronic gout, including not only chalk stones and abscesses, but from rigidity of the joints and other sequela, I will endeavour to explain the best mode of dealing with these various forms of local mischief. Sydenham was of opinion that under the influence of daily and long continued bodily exercise, not only were tophi prevented from forming, but indurated tumours even of considerable standing occasionally disappeared; at the same time he remarks, that this only ensued in cases where the chalky tumours had not converted the skin into a substance like themselves.

Boerhaave has an aphorism to the effect that good may be done by proper treatment, even in the tophaceous variety of gout, and others have entertained still more sanguine expectations from remedies.

False ideas of the composition of gouty concretions at one time led to the proposal of acid lotions, and a mixture of hydrochloric acid and oil of turpentine was occasionally employed for this purpose.

Alkaline remedies, however, gained the most favour, notwithstanding that their value could not be reconciled with the idea of the chalk-stones having the same composition as bone earth; and we find Aetius making use of a mixture of quicklime and nitre (probably an alkaline carbonate) mixed with lard; Trallianus also employed a similar compound, and Van

Swieten made a composition by heating together crude tartar and quicklime, a solution of which in water he applied to the gouty tumours, and asserted that it was followed by remarkably good effects, and sometimes by the total dispersion of the swelling in the course of a few days.

Sir C. Scudamore, from considering the easy solubility of uric acid in a solution of potash, was led to the employment of this liquid as an external application, and remarks that in three instances of recent deposit, it was so successful that the concretion which had been visible under the skin was gradually removed; he ordered the solution of the Pharmacopœia to be mixed with at least an equal quantity of recently-prepared almond milk, sometimes with more, and rubbed on the part two or three times a-day.

When the concretions were of longer standing, he thought that, although much less could be accomplished, still that the case should not be abandoned; that even then the alkaline liniment would diminish the size of the tumours, and increase the mobility of the joints.

One of the common and slighter sequela of gout, if the inflammation has lingered long, is an edematous state of the limb, and this is more especially the case in the lower extremities, and probably proceeds from the vessels having been much weakened; but occasionally this condition is increased by defective secretion from the kidneys.

The edema, if dependent on local debility, is best remedied by the use of elastic stockings, accompanied by gentle friction with some slightly stimulating application, as camphorated oil; at the same time the limb should be elevated as much as possible on a foot-rest, to facilitate the free return of blood by the veins. If the kidneys be in fault, which is generally indicated by the presence of a trace of albumen in the urine, other remedies may be required, and the vapour or hot-air bath, saline diaphoretics, with gentle counter-irritation to the lumbar region, are of service.

If stiffness of any joint be left as the result of a gouty fit—and we have seen that even partial anchylosis may be caused by a single attack—then local treatment must be had recourse to, consisting in the use of friction and passive movement, but short of inducing tenderness of the joint. The friction may be effected with some simple lubricating embrocation, or one made somewhat irritating by means of ammonia or an essential oil, as of cajuput, and occasionally small blisters are of much advantage under these circumstances.

In using mechanical appliances to joints stiffened by gout, the cause of such rigidity should never be lost sight of, for much injury may be induced by a too harsh mode of procedure; gentle means, continued over a lengthened period, are most likely to be attended with success. In those cases the use of mineral baths, as those of Aix-la-Chapelle, Wiesbaden, Teplitz, Buxton, and Vichy, are often of considerable advantage, and douche baths and shampooing specially indicated.

Now and then I have ordered lint dipped into a weak solution of carbonate of potash, to be wrapped round the stiffened joint and kept moist by oil silk; this application has appeared to me of much service.

It must be borne in mind that stiffness and tenderness generally depend on two causes, partly on the urate of soda deposited in the ligaments, partly also on a chronic inflammatory condition, closely resembling ordinary inflammation, and kept up by the foreign matter; the last is capable of relief by the aid of counter-irritants and subsequent friction, combined with the internal use of small doses of iodide of potassium; the first is difficult to remove, but possibly the long-continued use of the potash solution, or still better, one containing carbonate of lithia, might have some power in causing its removal, especially if aided by the employment of the internal remedies we have already spoken of as available in these cases.

When chalk-stones are formed on the surface, the question of the possibility of their removal by treatment is often mooted, and the following is a summary of what may be done in such cases.

When the ears of gouty patients exhibiting the small nodules upon the helix are watched, it will frequently be found that a considerable change takes place in the course of a few months, arising from the falling off of old and the formation of new deposits.

Sometimes patients will unintentionally remove them by picking or rubbing the ears. These concretions, it will be remembered, are produced by a liquid exudation into the fibro-cartilage, which hardens after a time, and the integument covering the cartilage being thin, is easily penetrated, the nodule thereby detached, and a natural cure effected. The ear, for example, represented in Plate I., fig. 2, has undergone many changes during the time the patient has been under my own observation. If it be desirable on account of the size of any such deposit to remove it speedily from the ear, this can be accomplished, if it be in a semifluid state, by puncturing with a lancet, and squeezing out the crystalline matter by the aid of slight pressure; if the concretion is older, it can be detached in little hardened masses consisting of aggregated crystals. On account of the little susceptibility of the ear to take on inflammatory action, such treatment is not followed by any injurious consequences. Now and then small tophi may be separated in the same manner from other parts, but in doing so we should be careful to ascertain if they possess a deep origin, as this circumstance greatly influences the facility of the after healing.

When the concretions are formed around joints, and project so as to be of much inconvenience, forming tumours more or less resembling those delineated in fig. 8, p. 74, and fig. 9, p. 84; it may occasionally be prudent to puncture them with the lancet, taking care to make a small incision, and not to use much subsequent pressure in removing the creamy matter. Such an incision will often heal by the first intention; if not, the part may be kept moist with water dressing, or a bread poultice, and then after a short time healed.

Occasionally, when incisions have been made, and more frequently when the tumours have burst of themselves, the sores become troublesome, and remain open for a long time. This obstinacy arises from the urate deposit being very deep-seated, and continuing to approach the surface to be discharged; and, besides this, when air has been once admitted, the formation of pus generally ensues, and adds to the difficulty of healing. Under these circumstances the application of nitrate of silver is occasionally of use to restore healthy action.

Mr. James Moore, in his communication to the Medico-Chirurgical Society, recommends that when a severe fit of gout attacks a part in which there is an accumulation of chalky matter, a warm poultice should be applied, and if there be any threatening of gangrene, which I may observe very seldom happens, he advises stimulants and opium to be administered. If the cutis over a deposit opens, but leaves the chalky matter confined by the cuticle, he thinks a puncture should immediately be made, but that it is imprudent to touch with the lancet the skin itself, or even to make a large opening into the cuticle. He also is opposed to the use of much pressure for the purpose of squeezing out the gouty matter, and says that even a small puncture will permit some portion of the fluid to escape, and more will run out into the poultice, and so the tumour is removed, and the symptoms commonly improve. When the inflammation has subsided, greater freedom may be used: some portion of the cuticle can be removed to facilitate the discharge, and gentle pressure also employed. If an ulcer has much chalky substance at the bottom, this should not be attempted to be got rid of by the knife, as it might cause gout, or set up much inflammation; and, as the deposited matter is in separate cells, an incision would remove but little of it. Caustics employed with caution answer better, for, by destroying the cellular membrane that confines the urate of soda, it often enables it to escape. Mild dressings should be applied, as all stimulants are hurtful. It should be borne in mind, in order to prevent disappointment, that these ulcers are often of very long duration; and this can be readily understood when it is remembered that not unfrequently the deposit of urate of soda extends from the surface down to the joint itself, as will be seen in the drawings, Plate III., figs. 2 and 3.

In concluding our remarks upon the local treatment of gouty chalk-stones, I may add that it is a judicious rule to interfere with them as little as possible by surgical means, as small advantage can be obtained, and great mischief occasioned.

Diet and Regimen proper in Chronic Gout and Gouty

Habits.—Of the importance of a regulated diet and of attention to regimen in the cure of chronic gout, and in order to prevent the returns of the disorder, there can be but one opinion, all experience and authority are in its favour. Galen affirmed that it was impossible to cure those who indulge in eating or drinking, because by their intemperate way of life they are constantly adding to their disease; and Sydenham wisely said, that however valuable remedies were in chronic gout, they were insufficient single-handed, and need be accompanied with great care as to diet; and in alluding more particularly to his own case, remarked that moderation in meat and drink must be strictly attended to, in order that the stomach should receive no more food than it can easily digest, and no fresh fuel added to the disease. But on the other hand, he considered that the opposite extreme was equally injurious, as he had experienced in his own person; for abstinence, says he, weakens the parts, by withholding from them their due proportion of that aliment which is necessary for supporting their vigour and strength. Cullen, although doubting the power of medicines, thought that much might be done by proper attention to regimen, feeling fully persuaded that any man who commenced in early life a constant habit of bodily labour and abstinence from animal food, would be preserved from gout, even if he inherited the disease.

In chronic gout the rigid diet, so necessary in the acute paroxysms, must be replaced by one capable of supporting the strength of the patient, but as all which exceeds this is productive of injury, there is no little difficulty in correctly apportioning it. In respect to this point no better rule can be laid down to the gouty subject than that of Sir William Temple, who remarks, "Simple diet, limited by every man's experience to his own easy digestion, and thereby proportioning as near as can be the daily repairs to the daily decays of our wasting system." As the exacerbations of gout abate, the diet may be gradually improved; some of the farinaceous matter replaced by fruit, fish, or fowl, and afterwards by meat; it is of much consequence to avoid all indigestible dishes, and especially such as contain free acids, as these are apt to bring back the paroxysm. The use of an exclusively vegetable diet has occasionally been recommended in the treatment of gout, and cures have been related in which, by its employment alone, patients were not only kept free from it, but their chalk-stones also disappeared; notwithstanding this improvement, a return to an animal diet was immediately followed by an accession of the disorder. Experience has clearly shown, that gout cannot be successfully treated by abstinence from meat, although a careful restriction as to quantity, so as not to exceed that which is necessary for the proper sustenance of the body, is of much importance. Examples are not wanting in which gouty persons have entirely regained their health by being reduced to poverty and obliged by daily labour to gain a spare sustenance; and Cornaro is said to have freed himself from gout and to have lived to a hundred, by diet alone, although he did not commence his change of living until he was past forty years old. But such a sudden change although occasionally successful, would in many instances, bring on a paroxysm of the disease, and not unfrequently be attended with danger.

One of the best methods of limiting the quantity of animal food is to make the number of dishes very few, as not only are mixtures of different meats more difficult of digestion than an equal quantity of one sort; but the appetite when not tempted, seldom desires more than the stomach is capable of digesting properly, or than is good for the patient.

The most digestible meats, as mutton, well kept beef and poultry, with the white kinds of fish, as cod-fish, sole, and whiting, may be partaken of; but salmon, veal, and pork should be avoided, as well as salted meats, cheese and raw vegetables, which, with highly seasoned dishes and rich sauces, are likely to induce dyspepsia.

Potatoes, being valuable in giving certain constituents to the blood which are essential to its healthy composition, as likewise boiled greens, turnips and carrots, may be eaten sparingly.

All stone fruits, apples and pears, unless baked, should be ignored; but strawberries, grapes, oranges, and other succulent fruits may be enjoyed in moderation. Strawberries were stated by Linnæus to prevent the occurrence of gouty attacks when habitually taken. These sub-acid fruits, doubtless, owe their efficacy to the abundance of alkaline salts they contain, which are decomposed in the blood, and appear in the urine in the form of carbonate of potash, and thus stimulate these organs to increased action.

Not only the character of the diet, but the time of taking food must be regulated; it is desirable, if possible, that the gouty man should dine in the middle of the day, or not later than three or four o'clock; that meat should be taken at that time only, except when circumstances render its more frequent exhibition advisable, and late suppers should be avoided. In speaking of animal food, I would not include either an egg, which, when it agrees with the stomach, may be taken at breakfast, or in some cases a small rasher of broiled bacon, carefully avoiding the lean portion, which on account of its hardened fibre, is of difficult digestion.

Wine or malt liquor should not be allowed, and if alcohol in any form be requisite, a little weak brandy, whiskey, or gin and water may be had recourse to; this should be the rule, but it is frequently necessary to make exceptions, as from long habit, wine may be essential to the proper performance of digestion; and in such instances, a little sound sherry, as Amontilado, or Manzinilla, is best. Port wine must be absolutely forbidden, and except in peculiar idiosyncrasies, Hocks, Moselle, clarets, and similar wines should be shunned; but it now and then occurs that these latter wines agree with the patient better than sherry; and the same remark applies to good Madeira. It is of the greatest moment in all cases, that the patient observe extreme moderation; one or two glasses of wine taken with the principal meal is generally sufficient, but the amount cannot always be specified, and must necessarily depend, not only on former habits of life, but also upon the age and strength of the patient, and other constitutional peculiarities.

Sydenham, in alluding to this subject, says that at least the first part of the old saw is true, "If you drink wine you have the gout, if you do not drink wine the gout will have you."

The objections to the use of malt liquors as ale, beer, and porter, are equally strong if not stronger than those which are urged against wine. I have known several patients in whom the attacks were much prolonged by their partaking of such beverages; and not only does it lengthen the paroxysms of chronic gout, but gives a great tendency to their return. I remember a gentleman who was experiencing attacks every six or eight weeks, who simply by avoiding pale ale kept them off for more than a year, and some of the most chronic and inveterate cases I have ever met with, have been in persons who had brought on the disease solely by the use of strong malt liquors. It is by no means unusual to find such instances among the men connected with large breweries. When in the least degree hard or acid, malt liquors act powerfully in exciting the gouty paroxysm.

Milk has been especially recommended for the gouty, and it might naturally be supposed that from its nutritive powers and unirritating nature, it would prove beneficial. It appears that in many cases a strictly milk diet has been of much service, especially in the young and strong, but in some instances it has entirely failed, and in old people may not be unattended with danger. Sydenham remarks with regard to a milk diet that "It has done good as long as it has been rigidly attended to; the moment, however, that the patient swerves from it a hair's breadth, and the moment he betakes himself to the diet of a healthy man (no matter how mild and simple), the gout returns worse than ever."

Of tea and coffee in gouty cases little need be said, they should be taken in moderation and not too strong; if they cause indigestion, as sometimes occurs, cocoa may be substituted for them. It has been suggested that coffee may possess the power of preventing gout, seeing that in countries where it is extensively drank, as in Turkey, gout is scarcely known; but it must be remembered that in such countries, little wine or malt liquors are drank, and this fact would satisfactorily explain the exemption from the disease. The same may be said of tea, and the exemption from gout attributed to the Chinese.

Exercise is most important in gout, as inactivity tends powerfully to engender a state of system leading to its renewal; in the chronic form it is of great moment, and likewise in the intervals between the attacks. Sydenham's opinion of exercise is frequently expressed in his treatise, and in one passage he says, "Moreover, much as the pain and the great inaptitude for motion may seem to contra-indicate that remedy which I have so much extolled—exercise —it must still be undergone; since, although at the beginning of a fit it may appear impossible for the patient even to be carried to his carriage, much less to bear the motion of it, he will nevertheless, provided he make the attempt, in a short time feel as little pain when driven about in his coach, as when seated in his elbow-chair at home." And again, "In respect to the kind of exercise, riding on horseback, unless forbidden either by old age or a calculus, is by far the best. Indeed, I have often thought within myself, that if any person knew a remedy of which he wished to make a secret, equally efficacious in gout, as riding, or regular and steady riding on horseback, he might make a fortune."

For exercise to be useful in gout it should be moderate and regular; if excessive at any one time, it may produce injury; and if not regular, or its effects on the system not kept up, it is of little value. Foot and horse exercise are both good; carriage exercise less so, but still of much advantage when the others cannot be employed. Friction may occasionally be substituted for exercise when the latter cannot be taken to a sufficient extent. Sir William Temple remarked, that no one need have gout who could afford a slave to rub him; but without going to this length, it is certain that no inconsiderable advantage may be thus obtained.

In all cases the amount of exercise must be carefully apportioned to the age and strength of the patient; and although it has been occasionally advised and even practised at the commencement of a gouty fit, as in the case related by Van Swieten of a dancing master, who, having suffered twenty years from gout, kept his joints free from stiffness by getting out of bed and walking about as much as he could the moment he perceived the least remission of pain, and continued this every day,—still the practice is not unattended with danger, and cannot be recommended; besides which few patients can be found having the moral courage to pursue it.

Fresh air is likewise highly valuable, especially to those of weak habit; sometimes, when all other remedial and dietetic means have failed, fresh air has effected the object. A bracing air, such as is obtained in elevated localities, is peculiarly advantageous to many such subjects, and hence probably part of the benefit derived from a sojourn at mineral springs thus situated.

In certain cases, where the attacks are peculiarly dependent on the state of the skin and readily excited by the bleak east and north-east winds, change to a warmer climate becomes desirable, and the intervals of the fits may thereby be greatly lengthened.

Instances have been known when the complete change of residence to a much hotter locality has altogether prevented the returns of gout, and from my own experience I feel assured that it is often most valuable. Although gout is perhaps little prevalent among Europeans in India, still the influence of climate will by no means allow immoderate indulgence, and in our own army in the East gout is not uncommon.

Upper Egypt and Malta are favourable places of residence during the winter and early spring; some parts of Italy and Spain are also well fitted to fulfil the desired end; but the selection of the locality must depend much on the peculiarities of the case, as a climate found most beneficial to one gouty person may occasionally be productive of ill consequence to another; a circumstance easily explained by what has before been advanced concerning the nature and causes of the disorder. Exercise, fresh air, and change of climate produce their beneficial effects by giving tone to the stomach and digestive processes, by increasing the functions of the different secreting organs, and at the same time imparting strength to the nervous and muscular systems.

The cutaneous function must not be neglected either during the existence of chronic gout or in the interval; the clothing should be sufficiently warm to ensure the surface not being chilled, and the feet should be particularly protected; for this purpose flannel should be worn next the skin, and likewise woollen stockings, but any undue warmth or overheating of the body guarded against. The action of the skin may at times be advantageously excited by warm baths, sponging the body with tepid water, or still better, salt or sea water, followed up by friction with a coarse towel. The importance of a proper attention to the action of the skin will be at once evident, if we reflect that by means of this surface acid matter is constantly excreted, and when this is suppressed the blood necessarily becomes less alkaline, and a fit of gout thereby occasioned: and hence cold acts as an exciting cause of the disease, and warmth tends to its mitigation.

Lastly, the influence of the mind on the development of gout must not be lost sight of. Any mental disturbance tending to depress the nervous system is certain to be followed by injurious consequences to gouty subjects, and it is therefore of great moment in the treatment of gout, that all such influences should be carefully avoided, and the tranquillity of the mind as much as possible ensured. For this purpose late hours should be shunned, study and the cares of business laid aside, and the mind employed with pleasant thoughts and occupations. The fact that prolonged mental exertion of any kind powerfully affects both the assimilating and digestive functions is well established, and that such must necessarily exert a baneful influence on the progress of gouty affections is equally certain. Sudden violent emotions have occasionally been followed by an instantaneous relief of the paroxysm, but they are likely to be attended with danger.

In concluding my remarks on the management of chronic gout, it may be desirable to give a brief summary of the principal indications necessary to be fulfilled.

First, to treat the chronic inflammation of the joints by less heroic means than those employed in the acute disorder.

Secondly, to render the blood pure by augmenting the various secreting functions, more especially of the kidneys and skin.

Thirdly, to restore the power of the digestive organs, which are usually much impaired in chronic gout.

Fourthly, to attend to the local mischief which the long-continued inflammation induces in the articular structures; and

Lastly, to carefully regulate the diet, and pay proper attention to other regimenal means.

Prophylactic Management of Gout.—The discussion of the prophylactic management of gout need not be dwelt upon at length, as we have already anticipated much in detailing the treatment of chronic gout; a few words however, may not be out of place.

If an individual be subject to biennial or annual fits of gout, or even more frequent paroxysms, and the general health otherwise good, proper attention to diet and active and regular exercise will generally prevent an increasing frequency in the recurrence of the disease, and sometimes even prolong the intervals. In such cases as the time of the fit may be calculated with tolerable accuracy, I believe, much may be effected by a rigorous attention to diet a little before the expected return, and by having recourse for a time to the use of properly chosen salines as previously described, the selection being made to suit the peculiarities of each case.

Mineral waters act in a similar manner, and possess the advantage of being accompanied by change of air and scenery, and absence from the cares of business; but on the other hand, they have their disadvantages, as they cannot be so long persevered in, are seldom taken at the most desirable period, and are often attended with many serious inconveniences, from which the other is exempt.

It has been asserted, that colchicum given before the expected visitations exerts a beneficial influence in warding them off; and Sir Henry Holland relates an instance in which he gave it daily in moderate doses in combination with quinine, for two years, not only with entire exemption from gout, but with singular benefit to the general health, when previously scarcely two months had passed over without an attack. In certain cases colchicum may be advantageously so prescribed, but I should feel more disposed to trust to simple salines, or combined with aromatic bitters if the digestive organs be much impaired; the latter treatment when judiciously exhibited can be followed by no injurious results, and in many cases has proved so successful as to have permitted the patient even to indulge in wine, without being tormented by his enemy.

CHAPTER XIII.

TREATMENT OF GOUT:—MINERAL WATERS—GENERAL REMARKS ON THEIR EMPLOYMENT—ALKALINE WATERS OF VICHY—MODE OF ACTION OF—REPORT ON THEIR VALUE BY A COMMISSION OF THE FRENCH ACADEMY—AUTHOR'S EXPERIENCE OF THEIR VALUE—SALINE WATERS OF WIESBADEN—THEIR NATURE, ACTION, AND VALUE IN GOUT—SULPHURETTED SALINE WATERS OF AIX-LA-CHAPELLE—EMPLOYMENT IN GOUTY CASES—CARLSBAD WATERS—INFLUENCE OF MINERAL WATERS CONTAINING LITTLE SALINE MATTER, AS OF WILDBAD, TEPLITZ, BUXTON, ETC.—SUMMARY OF THE TREATMENT OF GOUT BY MINERAL WATERS.

FROM the opinion expressed in the preceding pages of the efficacy of dilute saline solutions in the treatment of chronic gout, it will be no matter of surprise, that the subject of mineral waters should be next discussed, with a view to ascertain the real value of these agents in different forms of the affection; the reputation which many of these waters have acquired, shown by the large number of patients who annually resort to the different springs, will sufficiently justify our devoting some short space to the consideration of the most important of them.

All mineral waters possess one action in common, derived from the influence of the water itself, and it is a well established fact, that this agent when absorbed in large quantities stimulates powerfully the processes of the animal economy, and increases the various secretions. But in less important respects, these waters differ considerably from each other; those which contain iron augment the blood corpuscles and restore the impoverished blood of anæmia; those rich in sulphur in the form of sulphides, have their action especially directed to the skin; when sulphates of soda and magnesia are the preponderating ingredients, the intestinal canal is peculiarly influenced and purging produced; and lastly, when the alkaline carbonates form the principal constituents, the reaction of the secretions becomes sensibly affected, and the composition of the blood materially altered.

The mineral waters employed in the treatment of gout differ very considerably; some owe their therapeutic value to the nature of the saline ingredients they contain, which have the power of altering the condition of the blood and secretions; others may be looked upon chemically as almost indifferent, except from the water in their composition; many owe part of their efficacy to elevated temperature.

Among the first class may be reckoned the springs of Vichy, Wiesbaden, Aix-la-Chapelle, and Carlsbad; among the second, those of Wildbad, Teplitz, Gastein, Buxton and Bath. It may be observed that several of these latter springs are situated very high above the level of the sea, and probably the pure and bracing air of these localities, the deeper inspiration which it occasions, and the stimulation of the system thereby induced, may give rise to much of the improvement in patients who resort thither for the restoration of their health.

Mineral Springs of Vichy (France).—As Vichy is much resorted to not only by gouty invalids of France and many other parts of the Continent, but England also, and as the waters are imported into this country and artificially prepared here, it is a matter of importance that we should investigate their value in the treatment of gout, and the cases best adapted for their administration; for it will be found that these waters are exceedingly potent, and when injudiciously taken, capable of producing very mischievous effects. An elaborate analysis of the waters from the many different sources of Vichy and its environs, will be found in Appendix D, from which it may be gathered that they resemble each other very closely in composition, that bicarbonate of soda forms their chief ingredient, averaging about forty grains to the imperial pint, and that other carbonates, although they augment the alkaline property of the waters, are but of secondary importance. The water from the Grande Grille and Hôpital is hot, from the other sources it is cold or nearly so.

Bicarbonate of soda, when thus administered, becomes rapidly absorbed into the blood, exalts its natural alkalinity, and if long continued, causes a species of solution of the blood, and hence these medicines have been called fluidifiers or antiplastics, and deobstruents; and MM. Trousseau and Pidoux, in their "Traité de Thérapeutique," assert that they have noticed ill effects to result from the abuse of alkalies taken in the form both of Vichy and Carlsbad waters. Dr. Petit speaks of their neutralising the uric acid in the blood, or rendering it soluble by the formation of a urate, but this is evidently an erroneous idea, for we have experimentally proved that uric acid always exists in the blood as such. The presence of soda in the system in increased quantities appears specially to affect the function of the liver, and sometimes restore it to a healthy state; this may partly be explained by the fact, that the bile itself is a species of soda salt, consisting essentially of two organic acids, the glyco- and tauro-cholic acids united with soda; and gout, or at least the diathesis leading to its production, is often closely connected with deranged hepatic function.

The effect of the Vichy waters on the urine are readily recognizable. M. d'Arcet who made many observations on this subject, states that one glass, containing about fifteen grains of bicarbonate of soda, when taken in the morning fasting, is not sufficient to render the urine alkaline, although it sensibly diminishes its acid re-action; when two glasses are taken under the same circumstances, the urine quickly becomes alkaline, but remains clear, and that passed during the subsequent eight or nine hours has the same characters, after which time it re-acquires its natural acidity; three or more glasses of Vichy water causes the urine to continue alkaline for twenty-four hours, the transparency of the fluid remaining as in health.

When the Vichy waters are employed in the form of the bath, redness and slight irritation of the skin is sometimes produced, especially if the water be not diluted.

We have evidence that the saline matters become absorbed by the skin with great facility, from the fact that one bath is usually sufficient to render the urine alkaline, even without the internal exhibition of the waters; this has been stated to be the case by MM. d'Arcet, Chevallier, and Dr. Petit.

When at Vichy I made a similar observation, taking a bath for twenty minutes composed of equal parts of Vichy and ordinary water. The urine before entering the bath was strongly acid, but on leaving it, its alkaline reaction was well marked and remained so for more than an hour. This alkalization of the urine has usually been regarded as a decided proof of the absorption of the soda salt by the skin; but it is right to mention, that the same has been asserted to have been produced, by an ordinary warm bath, and the effect ascribed to the increased action on the skin, causing an augmented elimination of acid.

The secretions of the various mucous membranes are also influenced, especially that of the bladder, which becomes less tenacious, and often diminished in quantity. The perspiration has likewise been supposed to undergo a change of re-action; the bowels are seldom influenced, unless the waters are improperly administered.

For the first few days of taking the waters, few symptoms are observed, but occasionally patients complain of some weariness of the limbs, weight on the head, and a feeling not unlike a slight approach to intoxication accompanied with a desire for sleep, and sometimes there is an increase in the disease for which the treatment has been adopted. These first phenomena are not considered of any importance, and if the medication be continued, they disappear and are succeeded by a feeling of increased vigour.

If the same symptoms return after the treatment has been pursued for some time, their significance is much greater, as they indicate a condition of saturation of the whole system, and the amount of the waters must be at once diminished or discontinued, to be resumed again or not according to circumstances.

Use of Vichy Waters in the treatment of Gout.—In 1840, the French Academy of Medicine caused a report to be drawn up by a commission formed to investigate the subject of Vichy waters in the treatment of gout, and in pursuance of their inquiry, many questions were asked of the late Dr. Petit then Médecin Inspecteur at Vichy; we shall perhaps place the subject in a clear and simple light by giving a short summary of the report thus elicited.

Dr. Petit considers that the waters may be employed when a fit is impending, and also when it has begun to develop itself, and the accompanying fever, if simply dependent on the articular affection, and in no way connected with any disease of the organs of the chest or abdomen, need not be regarded as a contra-indication. However, there are certain patients who are very susceptible and irritable, and in whom the tolerance for the waters diminishes or entirely ceases when an attack of acute gout affects the joints; and in such cases it is right, either greatly to decrease or altogether to suspend their use. On the decline of the fit it is also necessary to act with much prudence, for fear of reproducing the attack. Active treatment should not be recommenced too soon, and it is especially necessary to avoid the early use of the bath.

The results are much more prompt, more complete, and consequently more striking, in acute than in chronic gout, in which the intervals are often short, and sometimes scarcely exist, and where the treatment must be long persevered with, in order to give any hope of the patients regaining the use of their joints, and even then the result is by no means certain. During a course of treatment in chronic cases, the disease may occasionally assume an acute character, but this is by no means essential for the success of the cure.

Dr. Petit considers that chalk-stones are occasionally absorbed, although this is a rare occurrence; but he thinks that when patients are submitted to the alkaline treatment, and this is persevered in, it is rare that new concretions are formed.

The effect of the Vichy treatment is to diminish the violence of the fit, and somewhat abridge its duration, but its chief object is to combat the proximate cause of the disease, and prevent its return.

Dr. Petit remarks that, as a rule, the Vichy waters agree well with the gouty, but he advises moderate doses to be commenced with, as five or six glasses per diem, and the administration of a bath. If these be easily supported, the number of glasses may be increased to twelve or fifteen. Some patients have taken as much as twenty, or even five-and-twenty glasses, without inconvenience, imagining that if relief be obtained from small quantities, much more advantage will accrue from larger, and so the prescribed amount is often exceeded. Certain individuals have been known to drink thirty, forty, and fifty glasses per day; and it was affirmed, although the statement can scarcely be credited, by one gentleman, that he had taken as many as eighty-four glasses in the twenty-four hours.

Dr. Petit considers that the waters of Vichy owe their efficacy as remedies for gout, to the fact of their containing so much soda, and that other waters similarly constituted, would have the same efficacy. He also thinks that as the bicarbonate of soda exists in solution in the waters, they are useful when taken at a distance from their source; but that, as a rule, they do not sit so easily on the stomach and cannot be taken in so large quantities as at the springs.

During the first and second years of treatment, full saturation of the patient is considered of advantage, and for this purpose at least a month is necessary; and that considerable benefit is often obtained from prolonging the stay beyond that time, especially if there exist any stiffening or partial anchylosis of the joints.

Patients occasionally experience a certain repugnance for the waters, often accompanied with want of sleep, and a feeling of agitation, and sometimes this is exhibited at an early period. When it occurs the treatment must be at once discontinued.

In appendix E will be found three cases illustrative of the Vichy treatment: the first, one of acute gout; the second, gout complicated with calculus; and the third, an instance of the chronic form of the disease.

Having thus exposed the principal views on the treatment of gout by the use of the Vichy waters held by Dr. Charles Petit, a gentleman who had abundant opportunities of becoming thoroughly versed in the subject, it is right to observe that they are not generally agreed to even by French physicians: for example, Dr. Durand Fardel, Inspector of the Sources of Hauterine near Vichy, who has also written on the subject, differs considerably from Dr. Petit in his views on several important particulars; for although he is fully of opinion that much benefit is often derived from the use of the Vichy waters in gout, and that if they do not cure the disease, still a salutary influence is exerted upon the general health, as well as on the symptoms of the malady, he nevertheless considers that their exhibition demands much caution. Dr. Durand Fardel believes that Vichy waters do not cure gout by specially influencing the uric acid, but by producing an alterative action, similar to that of several other mineral waters. As they act as general excitants to the whole organisation, and especially to the secreting organs, they should only be employed under certain circumstances, which may be thus briefly stated.

Vichy waters should not be taken either at the commencement of a fit of gout, or during its continuance, or when it is threatened, or even on its decline, until we are fully assured that it has completely passed off.

The time most favourable for the exhibition of these waters is during the complete intervals of the attacks.

With these views M. Prunelle seems to coincide, for, while he admits that the waters may be given with perfect safety in chronic and atonic forms of gout, and when the digestive organs are much affected, he considers that in the acute articular form their use is not unattended with danger, on account of their liability to produce suppression of the joint affection, and the development of some of the more serious forms of the disease.

There are several cases on record of gouty subjects having died suddenly soon after commencing the Vichy treatment, but many of these patients were suffering from organic disease of some important organ in addition to gout. In other instances the disorder appears to have been rendered more chronic from the same cause, and sufficient evidence of the occurrence of ill effects has been given to make it advisable to use great caution, not only in the mode of their employment, but likewise in the selection of cases in which they should be adopted.

Having seen cases of gout exhibiting all its phases, in which Vichy waters have been exhibited, and having witnessed the plan of treatment adopted at the baths, I feel entitled to give an opinion upon the subject. Vichy waters are undoubtedly potent agents, powerfully influencing the whole economy, producing a strong impression upon the system, and altering the characters of the animal fluids; and, if they are capable of effecting good, are likewise capable of causing much evil.

With regard to their exhibition in gout, I believe them to be often injurious in chronic cases, especially when the system is already lowered, and the rapid formation of urate deposits is taking place either in or around the joints or upon the surface of the body; that they sometimes increase these deposits, and still further depress the vital powers. I also consider that the constitution of Vichy waters is not such as is desirable for the majority of gouty cases, inasmuch as the carbonate of soda rather tends to diminish than augment the solubility of urate of soda, which is always present in the blood in these subjects. In many forms of chronic gout the baths are useful, but independent of any peculiarity in their composition.

In acute gout, either during the attack, or when a fit is impending, or has scarcely passed off, Vichy water, taken in very moderate quantities, is not likely to do harm, but the use of the bath is very hazardous, and should never be risked; and I am confident that when acute inflammation is present, other treatment is more appropriate.

In the complete intervals of acute gout, and more especially in strong and robust subjects, when the disease depends rather on increased formation than defective elimination of uric acid, and in cases in which the liver and digestive functions are considerably at fault, the employment of these waters is likely to prove most beneficial; in other forms of gout mineral waters of a different class may be resorted to with greater advantage than those of Vichy. These waters, it is true, act as all other mineral waters from the amount of diluent administered to the patient, and water, as we have already pointed out, is a powerful therapeutic agent in gout.

Mineral springs of Wiesbaden (*Nassau*). The physical and chemical characters of the Wiesbaden waters may be represented by those of the Kochbrunnen spring, which is the one almost exclusively employed. The water of this spring possesses the following properties. The temperature is about 160° Fahr., and it emits copious vapours; in odour it somewhat resembles quick lime, and the taste is not unlike weak but highly salted chicken broth; its density is 1006·6, and it contains in the 1000 parts, 8 parts of solid matter, and 0·5 parts of gas. The detail of the analysis by M. Fresenius will be seen in Appendix D.

When the water is allowed to remain in contact with the air, as occurs in the baths, a pellicle forms on the surface, of a somewhat greasy appearance, but, in reality, it consists only of carbonate of lime, which the escape of carbonic acid has rendered insoluble, and no appreciable amount of organic matter is present in it.

It will be evident from the consideration of the nature of Wiesbaden waters, that the effects produced upon the economy are due, in part to the exhibition of water at a high temperature, in part to the saline matters contained in it, and more especially to the chloride of sodium. The lime salts, as the carbonate and sulphate, probably possess some influence, as also the free carbonic acid and the small amount of iron; but these, as well as the remaining ingredients, play but a very secondary part compared with that exerted by the common salt.

The physiological effects produced by these waters when taken in small doses are, generally, some increase of the saliva and buccal mucus, giving rise to frequent deglutition and acuteness of the taste; a feeling of warmth in the epigastrium, accompanied with eructation of carbonic acid gas; along with these symptoms there is usually an increase of appetite, and improvement in the digestive functions. After the absorption of the waters into the system, the only appreciable effect is an augmentation of the urinary secretion. The bowels are usually not affected by the waters except they are taken cold, when they sometimes produce a slight action; on the other hand, if the patient drink them very hot, constipation may be induced.

If the waters be administered in larger doses, all the above named symptoms become more marked, and unless the skin and kidneys act very freely, slight diarrhœa is apt to occur, the stools being rich in the biliary constituents and other secretions from the intestinal tube.

These large doses when continued for several weeks, generally give rise to a diminution in the weight of the body, and this is more especially seen in the decrease of abdominal fulness. Cutaneous eruptions, especially acne, are often developed, and should the waters be persevered in beyond this point, symptoms indicating the saturation of the system with the saline matter appear, as indicated by great aversion to the waters, eructations, thirst, furred tongue, and a feeling of prostration, pointing out the propriety of discontinuing the treatment; for if persevered in, vomiting or diarrhœa, congestion of the organs of the chest and head, and other very unpleasant symptoms may arise. In still larger doses, they prove decidedly purgative.

Dr. Braun, in his work entitled Monographie des Eaux Minerales de Wiesbaden, has given some results of experiments made for the purpose of ascertaining the effects of these waters on the urine, which appear to show that a very large increase in the elimination of uric acid and urea arises from their exhibition either in the form of bath or when taken internally. If these results, which will be found in Appendix F, were confirmed by further observation, they would indeed go far to explain the value of the thermal treatment pursued at Wiesbaden; but Neubauer found no increase in the excretion of uric acid from the exhibition of the same water, and his results were obtained from repeated observations on two individuals.

The Wiesbaden waters have been strongly recommended in gout, and there are certain forms of the disease in which they may be advantageously administered; they are more especially indicated for subjects in whom the circulation is sluggish and the secretions deficient, also in cases in which there is much stiffness of the joints from previous attacks. It is not uncommon for an acute attack of the disorder to supervene after the waters have been taken for a short time, during which they must be discontinued. When there is much debility, the Wiesbaden treatment should not be attempted, and great care is necessary with regard to the use of the baths if there be any symptoms indicating disease of the organs of the chest, or of much injury of the kidneys. I have had the opportunity of watching the effects of the Wiesbaden waters upon numerous gouty subjects, but cannot say that they have been productive of much benefit, as they have not appeared to diminish the frequency of the attacks nor cause them to become less severe; but it must in fairness be added, that patients seldom resort to Wiesbaden from this country till their gout has become both chronic and intractable.

Did the waters possess the properties ascribed to them by Dr. Braun, they certainly should not bring on an acute accession, for the blood would be at once rendered too pure for the occurrence of the gouty fit to be possible. I believe that the waters are more adapted to the treatment of the chronic forms of rheumatism than of true gout; at the same time, I have little doubt that their proper exhibition may in some cases be attended with advantage.

Mineral Springs of Aix-la-Chapelle (Rhenish Prussia).—The waters of Aix-la-Chapelle are characterised by their peculiar odour, and many of the springs have also a high temperature; although apparently differing from the mineral waters we have hitherto considered, more minute examination shows that the difference is by no means so marked as might be at first anticipated. The principal spring is the Emperor's (Kaiserquelle), the water of which is clear, smelling strongly of sulphuretted hydrogen, temperature 135°, Fahr., and sixteen ounces contain about thirty-two grains of saline matter and twenty-six cubic inches of gas.

The analysis, Appendix D, shows that the water is saline and alkaline from chloride of sodium and carbonate of soda, and that the odour is due to the presence of a minute quantity of sulphuretted hydrogen and a small amount of sulphide of sodium.

The therapeutic effect of this water is similar, but less potent than that of Wiesbaden, in addition to which the sulphur it contains produces a marked influence over the cutaneous function. It is, therefore, indicated for gouty subjects in whom the skin is more than usually harsh and dry, and likewise in cases where a general feebleness of habit exists, combined with much rigidity of the joints; at the same time it must be remembered that the composition of the water offers nothing peculiarly fitted to combat the gouty diathesis, except that it contains a small amount of alkali in the form of carbonate of soda.

Waters of Carlsbad (*Bohemia*).—A reference to the analysis in Appendix D., will show that sulphate of soda is the principal ingredient of Carlsbad waters; but carbonate of soda and chloride of sodium are likewise important constituents, and their high temperature adds powerfully to their therapeutic influence. In the majority of patients a purgative action is induced by these waters, and this is followed by copious diuresis, at the same time some excitement of the vascular system usually occurs. Owing to the presence of the carbonate of soda, these waters possess the power of rendering the fluids more alkaline, and thus, in some respects, resemble those of Vichy.

The waters of Carlsbad are employed with most advantage in gout connected with fulness of habit, and combined with much derangement of the liver and deficient secretions from the alimentary canal; that is, in cases where the disease is peculiarly due to the excessive formation of uric acid: but in weak habits, or where the kidneys are seriously implicated, they should not be resorted to, as they may be productive of serious mischief from the powerful disturbance which they cause in the whole system.

In this category of mineral springs may be mentioned the waters of Kissingen, Marienbad, Homburgh, Ems, Soden, and Cheltenham, all of which contain a considerable amount of saline matter suitable to particular forms of gout; some of them are likewise slightly alkaline from the presence of carbonate of soda.

The second class of mineral waters are those which owe their therapeutic powers more especially to the influence of the water, often increased by its high temperature. Amongst these the more important are those of Teplitz, Wildbad, Buxton, Gastein, and Bath. The analyses of the first three waters will be seen in Appendix D., and may be taken as types of the whole class. The mineral constituents are insignificant, and can add but little to the therapeutic properties of the water itself; in Buxton waters an attempt has been made to refer their action to the large amount of contained nitrogen, but to say the least, the explanation is very problematical. These second class are more especially used in the form of the bath, or douche, but many of them are advantageously employed as internal remedies.

A very large portion of the visitors at Teplitz labour under some form of gout, and it is asserted that much benefit is derived from the administration of the waters.

The Teplitz springs are most suitable in gout attended with debility, and the baths especially indicated when the stomach is unable to bear a large quantity of liquid ; for long immersion in a water of low specific gravity, and containing but little dissolved in it, is favourable to endosmosis, and consequently considerable absorption ensues. As the solid ingredients of these waters consist chiefly of carbonates of soda and lime, with traces of iron, a slight increase of alkalinity is given to the animal fluids, and likewise some stimulant action to the secreting functions, which equally result, whether they are administered in the form of the bath, or taken internally.

The remarks made on the Teplitz waters apply to many others, and especially to those of Wildbad, Gastein, Bath, and Buxton, which contain a trifling amount of mineral ingredients, and cannot owe much of their efficacy to them. With regard to the efficacy of Bath waters, Heberden made the remark, that he had not been able to see any good result from their external use, either when gout was present or in the intervals, but on the contrary, he thought they appeared rather to increase the weakness of the limbs.

In certain forms of gout, especially after a course at other springs, the ferruginous waters are of considerable value, and of these the more important are Spa, Schwalbach, Pyrmont, on the Continent, and in this country, Tunbridge Wells.

From what has been shortly advanced concerning the nature and action of the several mineral springs which have acquired reputation in the treatment of the different forms of gout, it is evident that much caution is necessary to prevent the occurrence of mischievous consequences, and considerable judgment demanded to ensure success.

The subjoined rules may safely guide the practitioner in advising or proscribing their exhibition.

Their employment should be altogether prohibited when there is much structural disease in any important organ, especially in the heart or kidneys, and even when the organic mischief is slight, the greatest caution in their use is necessary.

Avoid giving them when an acute attack is either present or threatening.

Select the waters according to the nature of the case.—For the robust, and those of full habit, the alkaline saline springs should be chosen. When torpidity of the bowels predominates, the purgative waters; when a want of vascular action, the saline waters; when the skin is inactive, the sulphur springs; and when much debility prevails, or an atonic state is present, then the more simple thermal waters.

In all cases commence the use of the waters cautiously, and narrowly watch the effects; taking care not to oppress the stomach by giving too much in quantity, nor to induce debility or other injurious effects by a too prolonged sojourn in the bath.

In conclusion, I may add, too much should not be expected from mineral waters, as their influence, however advantageous, endures but for a limited period; whereas the causes of the disease are, in many cases, in constant operation.

CHAPTER XIV.

IRREGULAR FORMS OF GOUT:—PRELIMINARY OBSERVATIONS—DIFFICULTIES IN THE INVESTIGATION OF IRREGULAR FORMS OF GOUT—MODE OF ASCERTAINING THE TRUE NATURE OF DIFFICULT AND ANOMALOUS CASES—RETROCEDENT OR METASTATIC GOUT—IMPLICATING THE STOMACH, HEART, AND HEAD—ITS TREATMENT—GOUT AFFECTING THE DIGESTIVE ORGANS—THE HEART—THE RESPIRATORY ORGANS—URINARY ORGANS—THE EYE—THE EAR—THE SKIN—THE NERVOUS AND MUSCULAR SYSTEMS—TREATMENT OF THE DIFFERENT FORMS OF IRREGULAR GOUT.

WE now approach a subject beset with difficulties, and requiring the most careful exercise of the judgment to arrive at results at all satisfactory to the pathologist. That there are irregular forms of gout must be conceded by all who have turned their attention to the study of this disease; even before a regular attack the patient commonly experiences symptoms which may properly be classed under this head. These symptoms generally disappear on the occurrence of the paroxysm, but occasionally continue, although in a mitigated form, during the progress of the articular inflammation; they are often present during the intervals of the joint affection, and now and then occur in subjects who have never experienced a true fit, but who probably either inherit a gouty predisposition, or at least have been much exposed to its predisposing causes.

When at any time we can demonstrate that these symptoms depend upon the same diathesis, which leads to inflammation of the joints, we are certainly justified in referring them to a gouty state of the system, and considering them as forms of irregular gout. The difficulties in distinguishing the true nature of such anomalous symptoms are numerous; for we must remember that these patients may be affected with both functional and organic diseases, not necessarily gouty; for example, pleurisy may occur from exposure to cold, bronchitis from a similar cause, and although the course of such diseases may to some extent be influenced by the condition of the system, yet the complications can scarcely be denominated gouty : that this has been commonly done there is no doubt, and thus have arisen the numerous forms of irregular gout described by many of the older writers and especially those on the continent.

Many of the most powerful predisposing causes, such as indulgence in the use of fermented liquors, or too much animal food, tend to produce other forms of disease besides gout; and hence, when these occur in gouty patients, are not necessarily of a gouty character; such causes for example will often lead to cardiac diseases, as chronic valvular alterations, atheroma, and hypertrophy, and I have ascertained by post mortem examination, that even when such changes occur in subjects who have long been afflicted with gout, they have not the same composition or structure as those essentially connected with this disease; examples illustrating this point will be found in the Chapters on pathological anatomy. The long continued existence of chronic gout leads also to a depraved condition of the general nutrition of the body; and hence the slow production of many organic diseases, a circumstance which must not be lost sight of in this inquiry.

From a careful examination of many of the cases of anomalous gout recorded by different observers, I am of opinion, that by far the majority of instances reported by Continental physicians have no real claim to be considered as examples of irregular gout; that some were in no way related to that disease, and others only so far as that they occurred in gouty conditions of the habit.

Still there can be no question that the same disposition which commonly leads to the development of regular gout, may produce symptoms apart from the joints, and which are essentially of a gouty character; and it is to the investigation of such affections that we shall now direct our attention, remembering that it is of the highest importance to the advancement of medical science, that we should not use the latitude which the term irregular gout affords us as a cloak for our ignorance of any form of disease; but confine the word strictly to such cases as we can clearly demonstrate to depend directly on a gouty state of the system.

The irregular forms of gout have received various names, as *anomalous gout, non-articular gout,* and by the French certain forms are named *goutte larvée, goutte vague, podagra larvata*; sometimes the term *misplaced gout* is employed; and lastly, some writers include all the different affections we are about to describe under the head of *atonic gout,* as they are commonly met with in a condition of the system characterised by want of tone.

Various tissues and organs are affected in this form of the disease, which either exhibits itself by functional disturbance of the implicated organs; or frequently by a low form of inflammation, leading to considerable structural change.

Upon examining a case suspected to be one of irregular gout, we should investigate the history, in order to find if there be any hereditary predisposition to gout, and to what degree, and also to discover if the predisposing causes of the disease have been operative. The age and sex of the patient should likewise have due weight.

It should also be ascertained if there have been any joint affection, and the peculiarities of such, and whether the symptoms, supposed to depend on the gouty state of habit, be influenced by causes which are known to excite true gouty affections, more especially diet and atmospheric changes.

If there be much doubt, examine the condition of the blood, by which a clue may be obtained; for, as we have proved that gout is invariably attended with impure blood, from the presence of a peculiar principle, it follows as a necessary consequence that, when in anomalous cases the blood is not so altered, the symptoms cannot depend on a gouty diathesis; if on the contrary, the blood exhibit such impurity, it is a matter of the highest probability that the phenomena are so connected. I say, probability and not certainty, inasmuch as uric acid occasionally exists in the circulating fluid without any marked symptoms manifesting its presence.

To reduce the phenomena of anomalous gout to anything like a scientific precision worthy of the present age, the above considerations must not be lost sight of; for if the facts advanced in the preceding chapters be correct, and that they are so, satisfactory evidence has been adduced, I have no hesitation in affirming that what has now been stated with regard to the blood in cases of irregular gout must be so also.

There is generally some little difficulty in determining the presence of uric acid in the blood, as venesection is seldom absolutely requisite, and there is a natural repugnance to its performance, although but a single ounce be required. In such instances, I have advantageously had recourse to a blister, the application of which is sometimes advisable as a therapeutic agent, and can never be productive of injury; but it must be confessed that the examination of blister serum is not so satisfactory as that of blood, although in cases in which positive evidence of uric acid is afforded by it, the results are equally conclusive with those obtained from blood.

In treating of irregular gout we shall first speak of that form denominated retrocedent or metastatic, and then proceed to describe the other varieties of the disease, according as they affect the different organs or systems of the body.

Retrocedent Gout.—Gout is named retrocedent when a sudden disappearance of the articular affection occurs, followed by some serious mischief in one of the internal viscera, as if a metastasis or change of position had taken place; and the organs usually attacked are the stomach, the heart, or head. That such a metastatic action of gouty inflammation occasionally takes place, is undoubted; but at the same time it is no less true that the majority of cases which have been designated retrocedent gout, have been instances in which considerable mischief in an important organ had previously existed. To separate the true from spurious cases is a task of much difficulty.

When the *stomach* is thus attacked, the symptoms indicating the transference of gout are asserted to be an intense feeling of oppression and anxiety, often accompanied with spasm, pain, and vomiting. Coste relates the case of a soldier who, from the application of spirits of camphor to the joints, caused the gouty inflammation to subside, and was immediately seized with cold sweats, and the vomiting of a green-coloured bile; and Sydenham appears to have suffered from similar symptoms on the retrocession of gout from his limbs.

Sir C. Scudamore relates two cases of this form of disease, of which the following are short abstracts:—

A corpulent man, aged 47, had suffered from gout for twenty-five years, and had been treated with large doses of the eau medicinale, which much depressed him, and had also left off wine, in which he formerly indulged. Having one day been exposed to cold and damp, when suffering from gouty symptoms in his feet, although he felt no inconvenience at the time, yet on the following night he was suddenly seized with excruciating pain in the stomach, and such an oppression from flatus that he thought his stomach would actually burst; hot fomentations, ether, opium, and brandy-and-water relieved the alarming symptoms, which were followed by a severe paroxysm of gout in the knees and feet.

On another occasion this gentleman, from exposure to cold, had a return of symptoms, though of a different character; a kind of torpor came over him, the pulse was slow and languid, the skin cold, features collapsed, and breathing laboured, and both speaking and deglutition were difficult; stimulants were again successful in giving relief.

Case 2.—A gentleman, aged 52, had his first attack of gout when 31 years old, affecting one of his feet. When still suffering from gouty symptoms, and having eaten heartily, and drunk madeira-

and-water, he was exposed to the cold air. This suddenly induced an alarming oppression of breathing, cold perspiration on the limbs, and a sensation of burning rising up from the bowels, but no pain in any part; nausea was present, and a feeling of sinking, so as to cause some apprehension of fatal syncope; there was also palpitation of the heart. After drinking warm water, so as to produce vomiting, a large amount of acid matter was ejected from the stomach, and with immediate relief. At the time these symptoms were urgent the foot became easy, but on their abatement there was a return of acute gout in that part. This patient had a subsequent attack, similar in all its characters.

Besides these acute attacks in the stomach, patients labouring under chronic forms of gout are liable to suffer from dyspeptic symptoms, which are occasionally much aggravated when the joints are freer than usual from the inflammatory affection. The exact pathology of retrocedent gout when it attacks the stomach is difficult to determine. Is it ever inflammatory? or does it simply consist in violent spasm of the muscular coats of the organ? The cases which have hitherto been recorded do not suffice to settle the point, but the remedies which relieve would appear to show that it is functional. The application of cold is perhaps the most common cause of retrocession of gout to the stomach, especially when accompanied by a heavy meal or indigestible articles of food.

Dr. Home relates the case of a gentleman who exposed himself to wet and cold when suffering from slight inflammation in his feet, and the same afternoon enteritis followed, which in twelve hours proved fatal.

This last case, as well as others on record, can scarcely be considered as examples of retrocedent gout; for exposure to wet and cold will give rise to inflammation of internal organs, independent of the gouty diathesis; and it is extremely probable that when a patient is suffering from articular gout, the system is very susceptible to the influence of those causes, and consequently a less amount of exposure may produce serious mischief. It is difficult to conceive that if the internal inflammation was simply of a gouty character, it would lead to serious consequences, seeing that when gout attacks the joints, the injury caused by it is by no means so rapidly destructive as that induced by other forms of inflammation. I cannot say that an example to which I could apply the name of retrocedent gout of the stomach ever came under my own observation, although I have often seen symptoms arise in gouty patients which might probably now and then be so designated; but they have always been explainable by other means, and as Dr. Watson justly remarks, the so-called *gout* in the stomach has sometimes turned out to be *pork* in the stomach.

Without denying the possibility of acute gouty inflammation attacking this important organ, I am inclined until further evidence has been adduced, to doubt somewhat its occurrence, and to regard the so-called instances as either dependent on ordinary gastritis occurring in gouty habits, or as forms of acute dyspepsia, to which such subjects appear peculiarly liable, and depending on sudden loss of power in the stomach, accompanied by much spasm and flatus. Shocks to the nervous system, as powerful mental emotion occurring shortly after meals, are often productive of similar symptoms, and it may be that the repression of the articular inflammation may influence the nervous system in a somewhat similar manner. Hunter was inclined to suppose the effects of gout on the stomach and bowels as dissimilar from that in the extremities ; but Sir C. Scudamore thought that the established opinion of an occasional transference of inflammatory and spasmodic action from external to internal parts in cases of gout, had been clearly made out, and that it was important in practice as well as admissible in doctrine.

When the *heart* is seized with retrocedent gout there is generally a feeling of constriction about the chest, violent palpitation, intense anxiety, difficulty of breathing, accompanied by a very small thready pulse, and other signs of syncope. A well-marked instance of this form of retrocedent gout is related by Dr. Alexander in a gentleman, who, when suffering from a severe attack of gout, very imprudently applied snow to the painful foot, which produced at first a feeling of great relief from the pain, but was soon followed by a sensation of burning, and constriction at the lower part of his chest, as if a red hot iron wire had been placed round him, and that it was being pulled tighter and tighter; after this he could remember nothing, he was found sitting in his chair, with his usual florid complexion changed to a death-like pallor, respiration exceedingly slow and snatching, pulse 40, but almost imperceptible. He was restored by the aid of stimulants and counter-irritants. It was evident that in this instance the cold application had produced a sedative action on the constitution, but spasmodic as far as the heart itself was concerned.

Whether the heart is ever attacked with gouty inflammation is still a matter of doubt, for the instances in support of its occurrence are by no means conclusive; that it is frequently spasmodically affected is certain, and probably in most of the cases of retrocedent gout, which have thus proved fatal, cardiac mischief, as valvular disease, dilatation, or fatty degeneration, had previously existed.

When retrocedent gout attacks the *head*, apoplexy is commonly induced, but occasionally maniacal symptoms arise, which I have myself witnessed. Where the apoplexy has terminated fatally, serous effusion has been found in the brain, and such instances have usually occurred from the application of cold to the gouty limb, as by plunging it into cold water. That gouty inflammation should implicate the fibrous membranes of the brain, especially the dura mater, might be expected, but it seems probable that in many of the instances in which apoplexy has supervened, the brain was previously in a state of ramollissement, or otherwise diseased. I believe no demonstration has ever been afforded of true gouty deposits in these structures.

Dr. Copland relates an instance which came under his notice, of a medical man who experienced symptoms of retrocession in several organs within the space of a few hours ; he had had an imperfect attack of gout in the foot, and on its forsaking this situation, the bowels became affected with violent colic, then the diaphragm and lungs, causing the most urgent dyspnœa, and lastly the head in a slight degree ; after this the disease appeared in one foot, and subsequently in the other.

The treatment of these forms of retrocedent gout is simple; and we must be guided in each case by the knowledge we can obtain of its real nature. If the stomach be affected, and there is no evidence of the existence of inflammation, as shown by the want of much febrile disturbance, the condition of the tongue, the absence of tenderness on pressure, stimulants, as ether, chloroform, ammonia, and aromatics, may be administered ; and if the pain be very intense, opium. Vomiting should also be promoted by diluents, and counter-irritation applied over the epigastrium and left hypochondrium. Brandy is sometimes of great use, but it is well in these cases not to employ stimulants too liberally, as the symptoms often yield to remedies less likely to be followed by mischief. If there be evidence of an inflammatory state of the stomach, leeches, sedatives, as hydrocyanic acid, and alkalies, are indicated, but such cases are very rare.

At the time we are employing the remedies just enumerated we should not neglect the extremities, for, by the use of warmth and counter-irritation, we may frequently bring back the inflammation to these parts, and thus relieve the retrocedent affection.

When the heart is the seat of retrocedence, the same remedies may be applied, at least at the commencement, or until the symptoms of depression of the circulation have been removed; and when the head is implicated, similar treatment to that which would be adopted in the corresponding affections in other subjects, must be resorted to, but somewhat modified by our knowledge of the existence of gout in the system, and of the propriety of endeavouring to cause its return to the extremities.

Gouty affections referable to the Digestive Organs.—Dyspeptic symptoms are not unfrequently met with in patients who have never suffered from gout, but who strongly inherit it, or have sown the seeds of it by their mode of living; and in such cases the derangement of the digestive organs is often dependent on the same cause as leads to the fit itself, namely an impure state of the blood from the presence of urate of soda. Sometimes any difficulty in diagnosis which may be experienced is at once removed by the supervention of a fit, and a subsequent improvement in the general health; but, on the other hand, examples are now and then seen in which the gouty cause is equally present, and yet little or no joint affection manifests itself; and these are generally in persons who have led a very temperate life, but are strongly predisposed to the disease: slight threatenings of the toe affection are sometimes felt, sufficient to render the pressure of the boot uncomfortable.

Besides the symptoms described as premonitory of a fit, other gastric phenomena are occasionally met with, as gastrodynia, pyrosis, and enterodynia.

A gouty state of habit is most frequently accompanied by constipation, but sometimes diarrhœa ensues, and I have known individuals who appeared to escape fits of articular gout by such evacuation.

The gastric disturbance which precedes acute gout usually becomes increased in the chronic form of the disease; to such an extent indeed, that the patient is tormented even in the intervals of freedom from the joint affection, and cannot bear the slightest irregularity of diet: this probably depends on the augmented impurity of blood arising from the impaired state of the kidneys, and it is likewise a prominent feature in disorders directly connected with a granular state of these organs.

I have met with one instance in which the œsophagus was distinctly affected, so as to cause the greatest difficulty in swallowing, and this condition was relieved by the occurrence of articular gout: cases are related in which the rectum has been constricted from the same cause, and it should be mentioned that hemorrhoids are frequent attendants upon gouty patients, and due to the congested state of the portal system.

Gout affecting the Heart.—One of the more common symptoms produced by a gouty state of the system is palpitation of the heart, often accompanied with irregularity of its rhythm, and occasionally with pulsation of some of the larger arteries. In the majority of these cases, this condition is secondary to dyspepsia but at times it may be directly excited by the impure condition of the blood, and I have notes of some cases in which no organic mischief could be discovered in the heart, nor any signs of indigestion, and the symptoms ceased on the occurrence of gout in the joints; but in many gouty patients in whom palpitation is a prominent and constant symptom, hypertrophy or valvular disease exists sufficient to account for the symptom. It has been supposed that the structures of the heart are sometimes the seat of gouty inflammation, and great probability is given to the idea from their being so constantly affected in acute rheumatism; that such may occasionally occur I do not deny, but doubt that it is common. To consider calcareous deposits as a proof of gouty inflammation is altogether an error, for I have shown in a former chapter that even in gouty subjects with concretions of urate of soda in all the joints, the deposits upon the aorta are of a different character, consisting either of phosphate and carbonate of lime or of cholesterine and fatty matter. Dr. Stokes has observed, that when death has been attributed to gout in the heart, the cause has really been owing to some organic disease of that organ, and not as generally supposed to the direct influence of gout, a remark in which I most fully coincide. Arteritis, or an irritable condition of the aorta, is also occasionally produced by gout, and in some instances has caused a suspicion of the existence of aneurism.

Respiratory organs.—Cough and an asthmatic condition of breathing are frequently produced by a gouty state of system. A gouty cough is recognised by all practitioners, and often precedes and accompanies regular forms of gout; but occasionally dyspnœa of a very severe character, and to such an extent as to cause alarm, is connected with the presence of latent gout. A patient came under my care, having, it is true, some slight emphysema, but suffering at the time with great dyspnœa, so as to be unable to lie down, and was also much distressed by a hard dry cough. The usual treatment, as dry cupping, counter-irritation, and the use of expectorants, was adopted, but gave little or no relief; after a few days, the chest symptoms suddenly vanished on the occurrence of gout, first in the ball of the left great toe, and afterwards in the knee. Many similar cases are on record, which clearly point out that the respiratory organs are sometimes affected by gout; thus the pleura is occasionally implicated, and a species of dry pleurisy produced, and now and then the diaphragm is attacked, causing violent spasmodic cough. Asthma has been noticed to be very common in gouty families, and is probably often due to the existence of an impure condition of the blood.

Gouty affections of the Urinary Organs.—It is not uncommon to find a gouty patient complaining of much irritability of the bladder, sometimes accompanied with an increased discharge of mucus, and generally with scanty and high coloured urine, giving rise to a copious urate deposit on cooling. Such symptoms often occur in the intervals of gout, sometimes in subjects in whom regular gout has never developed itself. Sir C. Scudamore relates cases of the former in which there was a purulent discharge, relieved by the occurrence of gout in the feet; but from the description of the articular affections in some of these instances, I should be inclined to question their strictly gouty character, and ascribe the discharge to other causes. A few years since I was consulted on the case of a gentleman who was suffering from the following symptoms: great irritability of the bladder, shown by constant desire to pass water, and inability to sit still for many minutes; urine very scanty, and becoming thick from a pale deposit of urate of soda, closely resembling pus; pains in the hips and much palpitation of the heart, and so urgent were the symptoms that the presence of a stone in the bladder had been suspected by his usual medical attendant. From the history of the case it appeared that during the last year the patient's habits of life had been considerably changed; instead of taking much exercise and living plainly, he had led a comparatively inactive life and lived freely. From these circumstances, I was induced to suspect that the symptoms depended on a gouty habit, and treatment given with a view to correct such soon proved completely successful. Dr. Todd relates a case of cystitis apparently connected with the presence of gout, and many other instances in which the bladder has been involved are on record.

The kidneys appear occasionally to be attacked with gout, and when this takes place there is much pain in the back and other symptoms usually found in nephritic forms of disease. From what we have stated with regard to the altered structure of these organs in the majority of cases of chronic gout, it is not a matter of surprise to find indications of its existence during life. My own observations lead me to think that true gouty inflammation is often set up in the structure of the kidney, accompanied with deposits of urate of soda, not merely in the interior of the tubuli uriniferi but in the fibrous tissue itself. It may be that this structure, from the circumstances in which it is placed, being in constant contact with a fluid having an acid reaction, is selected as the early seat of gouty deposition; that it is frequently so chosen, proof has been afforded in the fact that white points of urate of soda were observed, with one exception, in every *post mortem* examination of these organs, and that in the exceptional case, but one joint in the body had been attacked. Although the ball of the great toe is apparently selected by gout in the majority of instances for its first invasion, it is quite possible to conceive that the fibrous structures of the kidneys may occasionally take the precedence though not recognisable by any subjective phenomena, as is sometimes the case with the heart in acute rheumatism. In many cases of articular gout I have known the urine to be albuminous for a time, but afterwards quite free from this principle; in these instances, the albumen may have been due to the presence of gout in the renal organs.

Instances are related in which the prostate gland and testicles have appeared to be affected with gouty inflammation and spasm, and to have been suddenly relieved on the occurrence of gout of the extremities.

Gout of the Eye and Ear.—A form of ophthalmia connected with gout has long been recognised, and appears to be tolerably well established; but as rheumatic inflammation of the same parts is equally allowed to exist, difficulties at once arise in the diagnosis. I have witnessed cases in which conjunctivitis and sclerotitis appeared to be distinctly connected with gouty diathesis, and instances are recorded of the distinct alternation of ophthalmia with inflammation of the joints. Gouty iritis is also said to occur.

In many parts of this work reference has been made to the little nodules of urate of soda upon the cartilage of the ear, and it has also been noticed that patients occasionally experience pains in the ears prior to an ordinary fit of gout. Dr. Graves, without mentioning the appearance of these small chalk-stones, refers to the twinges in the ears, which he attributes to a momentary congestion, and alludes to a gentleman the lobe of whose ear was sometimes so attacked, accompanied with agonising pain, but never lasting more than a few hours. Dr. Graves himself also suffered from similar attacks in the cartilage of the ear for about an hour, but they disappeared on the occurrence of gouty pains in the fingers.

When deposition of urate of soda takes place in the fibro-cartilage of the ear, little disturbance ensues compared with what results from the presence of the same matter in the articular cartilage of the joints, and hence in many patients is scarcely noticed; these phenomena are exactly the same as when a joint is affected, and constitute a true gouty paroxysm, commencing with infiltration of the tissue, afterwards followed by inflammation; the difference between gout in the ear and in a joint depending mainly on the amount of the inflammatory action, on account of the indifference of the fibro-cartilage to the foreign body.

Deposits are not unfrequently found upon the drum of the ear, and have been especially pointed out by Mr. Toynbee, but I have failed to discover a trace of uric acid in several examinations of them. Whether they are ever connected with gouty inflammation is at present a matter of uncertainty; they should especially be sought for in gouty subjects in whom the joints are much affected with chalk-stones, for if not found in such cases it is not probable that they would occur in any others.

Gout affecting the Skin.—Inflammation of the surface generally accompanies regular attacks of gout, but in these cases it seems to be only an extension from deeper-seated structures, and the skin is not primarily implicated. It is a point of much interest to ascertain if cutaneous diseases ever occur in direct dependence upon a gouty state of the system, and it will be found in the sequel that there is much evidence in favour of the idea.

Dr. Graves, in his Clinical Lectures, mentions that he has met with a singular affection in connection with gout, and quotes the case of an elderly lady of decided gouty habit, who was liable to a daily paroxysm of the following character: About three o'clock in the afternoon, her nose began to grow hot, and the heat continued for four or five hours, the part becoming first of a bright then of a purplish red colour, which spread to the upper part of her cheeks, and was accompanied by some uneasiness but no pain, and always subsided about the same hour in the evening. And Sir Henry Holland asserts that he has so often seen psoriasis prevailing in gouty families—sometimes alternating with acute attacks of the disease, sometimes suspended by them, sometimes seeming to prevent them in individuals thus disposed—that it is difficult not to assign the same morbid cause to these results, however unintelligible its mode of action under such different forms. Several cases of skin disease in connection with gout have come under my own observation, some have been of a pruriginous character and chiefly in females a little after the cessation of the catamenia, and others have consisted of chronic eczema and psoriasis, and have alternated or accompanied regular articular gout. I must, however, confess that although there existed much probability of their close connection with the diathesis in question, and some were greatly relieved by colchicum, yet I did not examine the blood for the presence of uric acid, and therefore the most convincing clue towards substantiating their real nature was wanting. Pruritus ani is a symptom frequently met with in gouty subjects.

Gout affecting the Nervous and Muscular Systems.—During the progress of regular gout, especially in its chronic varieties, and sometimes without the development of the articular disorder, the nervous and muscular systems occasionally manifest symptoms clearly referable to the presence of the gouty diathesis. These manifestations are generally functional, but sometimes dependent on inflammatory action which appears, as far as can be ascertained, to have the characteristics of true gouty inflammation.

We have already had occasion to notice cramp as a premonitory symptom of a fit, and it is one to which gouty subjects are very liable, not only during an attack, but likewise in the intervals of the paroxysms, and in certain cases it is increased to such an extent as to become a source of serious annoyance.

Somewhat allied to cramp is a peculiar affection noticed by Dr. Graves in certain gouty subjects, consisting in an insuperable desire on the part of the patient to grind his teeth, which appears to originate in a disagreeable uneasy sensation in the teeth themselves, and is for the moment alleviated by forcibly grinding them together, but immediately returns when the patient ceases to perform this action, which is therefore continued during the entire day when the disease is confirmed. When asleep, the patient no longer grinds his teeth, the grinding being in all cases the result of voluntary motion. Dr. Graves gives details of four persons so affected, and remarks that as this grinding continues for years as a daily habit, it produces great changes in those organs, affecting sometimes one side of the jaw, sometimes both; so that in confirmed cases, the teeth are ground down to the level of the gums. Having witnessed many instances of this kind and all of them in persons of the gouty diathesis, he is inclined to attribute the symptom to the existence of gout in the constitution, and its effect on the dental nerves.

One of the cases relating to this subject, contained in Dr. Graves's Clinical Lectures, is as follows: "A gentleman, aged 45, slightly made, muscular, and born of healthy parents, was attacked with shivering and loss of power of the left side after a severe wetting. He recovered under appropriate treatment, but in about a year afterwards, began to observe a tendency to grind his teeth, which gradually increased to such an extent as to prove a nuisance to himself and every one about him. Under these circumstances he applied to an eminent surgeon in Dublin, who applied the actual cautery behind his ears, slightly affected his system with mercury and extracted one of his teeth,—all with considerable relief which lasted six months. He then became as bad as ever, and applied to another surgeon, who tried iron in every form, without success; and subsequently, to a third practitioner, who used in addition to leeching, blistering, pustulation with tartar emetic, and various other remedies, but without any favourable result. All this time his medical attendants, so far from suspecting the presence of gout, ridiculed the idea of its existence. About three months ago this gentleman came to Dublin, went to dine at the house of a friend, and with some others, supped late at night and drank whiskey-punch. Next day he had vomiting, purging and epigastric tenderness, and on the day after, the ball of his great toe became swollen, hot, and exquisitely painful, leaving no doubt as to the nature of the affection. In this gentleman's case the grinding of the teeth is not constant, but is always greatest when the stomach is most deranged. The teeth in the under jaw are all sound; three or four of the molars of the upper jaw have been extracted. The four upper incisors are ground nearly half way through to the gum on the one side, while the others are very little worn. By pressing the tongue against the upper incisors, or by touching a certain point of one particular tooth, he can at any time arrest the tendency to grind, and can suspend it as long as pressure is continued in the manner just described."

From a careful perusal of the cases cited by Dr. Graves, I must confess, that I am by no means convinced that the peculiar symptom described by him, the grinding of the teeth, is dependent on the gouty state of the system, but should be more inclined to look upon it as connected with a peculiar form of the dyspepsia occurring sometimes in gouty habits.

Neuralgia is not an uncommon manifestation of gout, and may occur in various situations; sometimes the branches of the fifth pair are implicated, and frequently the sciatic nerve, and more rarely other spinal nerves. I have met with many instances of these different forms of neuralgia, which are exceedingly difficult to diagnose, unless alternating or accompanying joint disease. Local paralysis appears at times to depend on the existence of a gouty habit, and a case of facial paralysis came under my own care, which disappeared on the occurrence of regular gout, and the patient was afterwards subject to the ordinary forms of the disease. In such instances, it is a question if the neuralgia or paralysis is induced simply by the impure state of the blood, or whether a real inflammatory action is set up in the sheath of the nerves or the fibrous coverings of the spinal cord.

Sometimes the development of hysterical symptoms is caused by a gouty state of system and becomes relieved by the occurrence of articular gout. Such instances are usually seen in women who strongly inherit gout, especially when there is an irregularity in the catamenia, or soon after the period of their cessation, and seems to depend on a gouty condition of the blood, but wanting the exciting causes necessary to bring about an attack of the regular form of the disorder.

In some of these cases it seems probable that a gouty condition of the uterus, or its appendages, may be the primary cause of the hysteria.

More serious affections of the nervous system occasionally arise, depending on the central portions of the nervous system being involved. Sometimes epilepsy appears to be connected with a gouty habit. Van Swieten mentions a case in which the returns ceased as soon as a regular paroxysm of gout ensued, and two instances of the kind have come under my own observation; in one patient, an old man, several epileptic fits occurred before their nature was suspected, but in a short time joint affection showed itself and the head symptoms ceased; prior to the development of the articular gout, an examination of the blood, taken by cupping from the temples, had proved the existence of a large amount of uric acid.

Gouty mania is occasionally seen, and one instance which rapidly supervened after the cessation of the joint affection has been already alluded to in the present chapter. In another case where slight wandering occurred, the progress of the affection was interesting, showing the probability of the membranes of the brain being affected with slight gouty inflammation. A gentleman subjected to great mental and bodily fatigue, and likewise exposed to cold, became ill, the head was hot and painful, with wandering at night; in addition to which, considerable febrile disturbance was present; these cerebral symptoms did not yield to ordinary treatment, but suddenly disappeared when one of the great toes became painful and hot. The patient had very occasionally been subject to slight attacks of regular gout, but these were always confined to the great toes.

In connection with this subject, I may state, that in some cases of epilepsy, paralysis, and apoplexy, in persons not known to have had gout, I have found the blood rich in uric acid, and these cases were almost the only exceptions in which the circulating fluid contained this acid, when the patient was not labouring under gout or albuminuria; the value of this fact cannot be determined now, but must be left to future observations and inquiry. Are certain cerebral affections closely allied to gout, or does the shock caused by sudden mischief to the brain or spine, cause defective elimination of the uric acid by the kidneys? At present, I am inclined to regard the latter view as most probably correct. In connection with the subject of cerebral affections, I may state, that hemicrania is not uncommon in gouty subjects.

Instances of the spinal cord being implicated by gout have been noticed, and one well-marked case has come under my own care in a gentleman who suffered from pain and tenderness in the upper part of the lumbar spine, great pain in the legs, and hyperæsthesia, together with extreme depression of the system. During the manifestation of these symptoms which lasted for some weeks, gout appeared from time to time in moderate intensity in both great toes, and the result of the case, which was most satisfactory, gave probability to the idea that it was one of gouty inflammation affecting the meninges of the spinal cord. Dr. Graves has also related some cases occurring in gouty subjects, in which spinal symptoms manifested themselves during life, and the cord was found softened after death, but, from any evidence shown to the contrary, they might have been ordinary cases of softening of the spinal marrow; in one instance, it is stated that some relief was afforded when gout appeared in the feet, but this must not be taken as an absolute proof of its gouty character, seeing that the relief might have been due to the derivative effect of the inflammation in a distant part. As to the appearance of deposits of earthy matter upon the meninges of the brain and cord, and in the sheaths of the nerves, I may state, that in no instance has it been shown that they were in any way connected with gouty inflammation; they probably consisted of phosphate and carbonate of lime, and not of urate of soda, and the former salts never occur as the products of true gout; for when lime salts have been found in gouty concretions they have resulted either from the tissues in which they have occurred, or from ordinary inflammation having been set up around the true gouty deposits.

Treatment of Irregular Gout.—No simple method can be given for the treatment of the various forms of irregular gout, as it must necessarily differ so much in different cases. Some general rules may, however, be laid down for guidance. In cases in which the heart, lungs, urinary organs, or nervous system are affected, as these are parts of the body of much importance, it should be our endeavour to induce gouty inflammation of the extremities, which is best accomplished by warmth and moderate counter-irritation, as hot bottles, mustard poultices, and such applications.

We should also aim at correcting the gouty diathesis, by the adoption of the remedial means enumerated in the treatment of chronic gout, but carefully avoid the production of any depression.

When evidence exists of the presence of inflammation in any important organ, local depletion may be necessary, and the case may be treated as ordinary inflammation of the same part, but it should always be borne in mind, that a peculiar state of the system is present in these cases which modifies the symptoms to a great extent, and demands peculiar means for its removal.

The value of colchicum in the irregular forms of gout has not, I consider, been quite satisfactorily ascertained, although Sir H. Holland is of opinion that its influence is not limited to the removal of gout from the joints, but extends to the relief of the disease, even when assuming the most irregular and changeable aspects, as in the ophthalmia, headache, and bronchitis of gouty habits. My own experience accords completely with this view, as regards the value of colchicum in gouty inflammation of articular or other textures, but I have not yet sufficient evidence to enable me to decide whether the remedy be potent in removing symptoms which are simply functional, that is, entirely independent of inflammatory action.

CHAPTER XV.

Rheumatic Gout:—remarks on the use of the name—confusion arising from the employment of the term—different diseases, included under the head of rheumatic gout—cases of true gout to which the title is given—cases of sub-acute rheumatism—diagnosis of gout and rheumatism—capsular rheumatism—rheumatoid arthritis—the chronic rheumatic arthritis of Adams—nodosity of the joints of Haygarth—symptoms—anatomical characters—causes—pathology—diagnosis—table exhibiting the differential diagnosis of gout, rheumatism, and rheumatoid arthritis—treatment of rheumatic gout—diseases in connection with the gouty diathesis—prognosis of gout.

The term rheumatic gout is applied to so many different forms of disease that it is exceedingly difficult to define what is intended to be understood by it. The compound character of the name would naturally imply that the disorder itself is complex, and depending on a union of the two separate diseases, gout and rheumatism. It is often employed under this supposition, but still in many works the term is used to designate a disease altogether differing, as far as its true pathology is concerned, from both these affections.

Under these circumstances it will be necessary to enter somewhat fully into the characters of the different diseases which have been thus confounded together, and point out the method of clearly distinguishing each of them. But few authors recognise the combination of gout and rheumatism, and many are strongly opposed to the doctrine; no mention of it is found in the works of Boerhaave, Van Swieten, or of Drs. Cullen, Heberden, or Watson; and Sir C. Scudamore remarks in reference to this subject, that the textures which have been long affected with gout become so much weakened as to be very susceptible to vicissitudes of temperature; and in this way the general disorder may partake of rheumatism. It was only thus that he could attach any propriety to the very common expression, *rheumatic gout*. It would appear that the term is often made use of, but seldom attempted to be defined with precision.

Our first aim in the present chapter will be to state succinctly the diagnosis between gout and rheumatism in their acute and chronic forms, and then to speak of certain other diseases which have been called by the name of rheumatic gout, at different times and by different authors. To diagnose these disorders correctly is of great moment, as the appropriate treatment required for the various forms of disease thus frequently mistaken for each other is of a different character.

Gout cannot easily be mistaken for acute rheumatism when each is exhibited in its typical form; the subjects in which the diseases usually occur differ considerably, the first being most common in men after middle age, and in those who have lived freely; the second is at least as frequent in females, usually in the young and those of enfeebled powers. The characters of the diseases are also dissimilar. Gout, in its early attacks, ordinarily affects but one or two joints, and generally the ball of the great toe, and the inflammation is accompanied with little fever but much local pain, edema, and subsequent desquamation; the attacks are for the most part periodic, and gradually implicate a larger number of the joints. Rheumatism, on the contrary, affects many and large joints, and the upper equally with the lower extremities ; the fever is likewise out of proportion to the local inflammation, and, although it is apt to return upon re-exposure to its exciting causes, still no periodicity can be traced in its visitations. Gout may be further separated from rheumatism by the study of hereditary influence, the predisposing and exciting causes of the two diseases, as likewise the great tendency to acute cardiac affection in the latter. Notwithstanding the apparent facility of diagnosis certain cases are difficult to separate, as some which we have given in our description of acute gout, and require other methods of analysis, involving a knowledge of their more intimate pathology. In gout we have proved beyond question that the blood is invariably impregnated with uric acid, and we are in a position equally to prove that in genuine acute rheumatism this principle is absent; in an examination of forty cases of the latter disease exhibiting all its typical peculiarities, the salient points of which will be found in Appendix G, no trace was discovered by the process detailed in a previous chapter.

Furthermore, we have demonstrated that true gouty inflammation is always accompanied with the deposition of urate of soda in the structures primarily inflamed, and from the examination of the joints of several subjects who had suffered from acute rheumatism I can testify that no such alteration ensues. The former of these means of distinguishing gout from rheumatism can often be made available for clinical purposes, either by examination of the blood or blister serum, the latter can of course only be of service in pathological investigations. These methods of diagnosis are positive as regards gout, but negative as regards rheumatism, as the absence of the phenomena will in no way separate rheumatism from other diseases with which it is sometimes confounded.

In the chronic stage of the diseases, the separation of gout and rheumatism by the ordinary symptoms which present themselves becomes in some instances a difficult task, even to those who have given special attention to the subject, and the forms most apt to be mistaken or wrongly diagnosed, are chronic gout affecting both the large and small joints, and unaccompanied with any external deposits or chalk-stones, and certain forms of sub-acute rheumatism where the same structures are affected; the external phenomena are then almost the same, probably little febrile disturbance is present, the joints but slightly swollen, and no redness of surface.

An investigation of the history of the cases will do much: if the disease originally commenced in the toe, and gradually in after attacks became more extended;

if it began about the middle age, or bordering upon this, and the patient had lived freely, indulging in wine or malt liquors; then it is in all probability a case of gout. In many subjects the examination of the external ear will throw considerable light, and I have often been able to arrive quickly at a correct diagnosis by finding the presence of a spot or two upon the helix. Plate I. fig. 1, represents the ear of a patient having but one external deposit, and the true nature of his case was thus at first discovered, and in the chapter on chronic gout other cases will be found illustrative of the above remark. Instances occasionally occur in which the history, from peculiar circumstances, is of little value or cannot be procured, and where there are no external signs on which the diagnosis can be founded; these are rare, but any one frequently consulted on such subjects must have now and then felt a difficulty. In some of these cases I have derived much assistance from an examination of the blood or blister fluid, and a careful attention to the effects of drugs has often afforded much additional aid, as the inflammation of gout is relieved by the administration of colchicum in an infinitely more decided manner than that dependent on rheumatism.

Having shown how gout may be separated from rheumatism, the question arises, can they co-exist, and is there a disease to which the term *rheumatic gout* can properly be applied? For my own part, although far from denying the possibility of acute rheumatism attacking an individual predisposed to gout, or already having suffered from visitations of the disorder, or of gout supervening where rheumatism has previously existed; still I am convinced, after a long and careful study of the subject, that no combination of the two diseases, as assumed by the title, is ever seen in nature. In my own practice, I have found the name applied to many diverse maladies, sometimes to true gout, when it has travelled above the knees, especially when it implicates the upper extremities, and a patient frequently thus expresses himself—"Formerly I was subject to attacks of gout, but now I am suffering from rheumatic gout." Yet in such a case the disease has throughout its course steadily and characteristically progressed, and remains as typical an example of gout as on the first day that he felt the twinges of the toe. Sometimes the term is applied to chronic or sub-acute rheumatism, more especially when not commencing with rheumatic fever; but the term rheumatic gout is given, particularly by the medical profession, to a disease having a peculiar pathology, in no way related to gout, and not necessarily to rheumatism, and which Dr. Adams, of Dublin, has described under the head of Chronic Rheumatic Arthritis, the nature and symptoms of which we shall shortly consider.

I should mention that now and then gout in some of the joints is mistaken for rheumatism, and a careful perusal of Dr. Macleod's Lectures has convinced me that some of the cases included by that physician under the term *capsular rheumatism* are merely examples of gout. Dr. Macleod almost admits this himself when he states that the external phenomena are often very similar, the morbid appearances the same, and that colchicum is the specific remedy. If the contents of these chapters be attentively examined and analysed, much reason will be found to doubt altogether the existence of a special disease which is entitled to the name of *capsular rheumatism,* for it will be seen that in all probability many different disorders besides genuine gout are there recorded; for example, instances of affections arising from urethral discharge, and also of purulent inflammation of the joints.

Rheumatoid Arthritis, Chronic Rheumatic Arthritis, or *Rheumatic Gout.*—We find this affection distinctly pointed out by Heberden, who speaks of an articular affection, not commencing in the great toe, but preferring other joints, and in its progress differing so much from gout, and also from rheumatism, that it should be distinguished by some peculiar name from both; he remarks that in this disorder, though the pain is much less violent, the swelling is much greater than in gout, and the peculiarity consists chiefly in the great and lasting feebleness which is thereby occasioned, causing the limbs to be more weakened by it in two years than by regular gout in twenty.

It is the same disease which was denominated *Nodosity of the joints* by Dr. Haygarth, and considered by him to differ both from gout and rheumatism, and *Usures des cartilages articulaires* by Cruvelhier; and

Dr. Adams, who has most carefully studied its morbid anatomy, proposes the name *chronic rheumatic arthritis*. It has sometimes received a name dependent on its situation; for example, rheumatic gout, when the wrists, hands, and feet are affected; chronic rheumatism, when in the shoulder, elbow, or knee, either singly or simultaneously; and *morbus coxæ senilis*, when located in the hip. Occasionally it assumes an acute, or rather sub-acute, character, but more generally it is chronic throughout.

Dr. Haygarth was fully alive to the importance of designating this form of arthritis by a distinct name, but the term nodosity of the joints hardly expresses what is intended to be conveyed, as a nodose condition may be produced by many causes: chronic rheumatic arthritis is much preferable to rheumatic gout, for although the disease differs considerably from rheumatism in its pathology, still it is often excited by its attacks, and more resembles it in its symptoms.

Dr. Fuller describes it under the name of rheumatic gout, although he allows that it differs considerably from both affections.

If we agree to name a disease simply from its external characters, then I admit that the term rheumatic gout is not inappropriate; but if we advance further, and have regard to more intimate pathology, then I deny the propriety of the name: acting upon the former principle, we should be equally justified in calling some cases of scarlatina or measles by the compound term of rubeolo-scarlatina, and we know that these diseases were not separated two centuries ago; but we are now convinced that, although one disease may present some of the characters of the other, yet in their real nature they are altogether different, each being dependent on the presence of a specific poison in the system.

Although unwilling to add to the number of names, I cannot help expressing a desire that one might be found for this disease, not implying any necessary relation between it and either gout or rheumatism. Perhaps *Rheumatoid Arthritis* would answer the object, by which term I should wish to imply an inflammatory affection of the joints, not unlike rheumatism in some of its characters, but differing materially from it.

Space will not allow me to enter into very minute details of the symptoms of this affection, or to illustrate my remarks by quoting cases; I shall therefore give a short sketch of the history of the affection as I have met with it, pointing out any differences in the experiences of others, if such should be important.

This form of arthritis is met with in the young and old, in both rich and poor, and about equally in the two sexes, although, under different circumstances it may take on a slightly altered form. Dr. Adams considers that in males the hip joint is most affected, in females the wrists and hands, and that it is most commonly found among the labouring poor; but Sir B. Brodie, on the other hand, thinks that it is most common in the upper classes of society; a difference of opinion probably explainable, as I have suggested elsewhere,* by a difference in the class of patients more prominently brought under each surgeon's notice.

The affection, as far as my own experience enables me to form an opinion, more frequently occurs in individuals who have been exposed to the influence of powerful depressing causes, either mental or physical, but when it is excited by acute rheumatism, such antecedents are not met with; still, many cases have come under my notice, in which the patient was previously in good health, and the disease has arisen without any assignable cause. The most prominent symptoms are pain in the joints, attended at first with little or no swelling, sometimes increased at night and by heat; any attempt to move an affected joint augments the pain, particularly if it has been at rest, and I have known patients who have been quite unable to stir in bed on first waking; after a short time the joints enlarge from the increased secretion of fluid in the articular cavities, which is usually capable of detection by being soft and fluctuating to the touch; when absorption takes place, the swollen joints become gradually harder.

There is but slight accompanying fever, and little constitutional disturbance, but this depends much on the number of the joints implicated, which may be limited to one only, or extended to many; in the latter case, the patient is often reduced to a miserable condition of helplessness. In some cases the larger joints, as the knees, ankles, wrists, and elbows, are peculiarly selected, in others, the smaller articulations, but frequently both large and small indifferently. At times the affection assumes the characters of an acute disease, but more commonly the contrary holds good. Although this form of arthritis is migratory, affecting joint after joint, yet it seldom leaves any free from mischief when it has once invaded them.

---

* Review of Dr. Adams's Work.

Plate IV. fig. 1, represents the hand of a woman, in whom the disease was just commencing in this member, and it will be observed that several of the smaller articulations are much swollen from the presence of fluid in the cavities. The first phalangeal joint of the ring finger exhibits the phenomena in a well marked form; some distension of the wrist joint will also be noticed, depending on the same cause. In this patient the knees and other larger joints were so seriously injured, that she was much crippled.

Fig. 23 represents the hand of another patient, taken from a plaster cast, the peculiar deformity of which, namely, twisting outwards of the fingers, is produced by serious injury of the smaller articulations.

A chronic form of the disease principally affecting the smaller joints, and especially the last phalanges of the hand, is frequently met with. Heberden has a small chapter on the subject in his Commentaries, entitled *Digitorum nodi*, and consisting of the following query:—

"What are those little hard knobs, about the size of a pea, which are frequently seen upon the fingers, particularly a little below the top, near the joint? They have no connection with the gout, being found in persons who never had it; they continue for life; and being hardly ever attended with pain, or disposed to become sores, are rather unsightly than inconvenient, though they must be some little hinderance to the free use of the fingers."

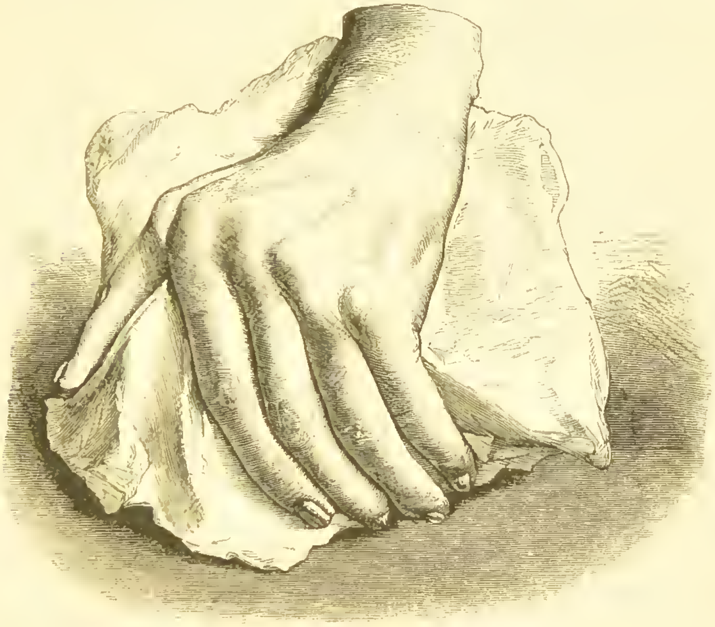


Fig. 23.*

Dr. Begbie, who thinks the nodules are connected with gout, or at least that they are only met with in what he terms a gouty diathesis, although he allows that they are often found in those who have never experienced a fit, nevertheless admits that these tophaceous deposits are different from chalk-stones, being neither so soft or fluctuating at first, nor so hard, or earth-like, in the more advanced stages; they do not acquire the same size which the chalky concretions sometimes attain, neither do they appear to be so immediately beneath the skin, nor do they ever burst or discharge the thin mortar or gritty chalk of the gouty deposit.

---

* Fig. 23. A hand much distorted from rheumatic arthritis.

I believe Heberden's statement of their having no connection with genuine gout to be correct, and they are certainly found in other subjects than those of a gouty diathesis. I have noticed that they frequently occur in families, but as far as my own experience goes, I cannot recall ever having seen them in patients who had experienced a true fit of gout. It must be remembered, that I completely separate these nodules from true gouty depositions which so frequently occur about the fingers, but can always be readily distinguished. The *digitorum nodi* of Heberden are produced by the arthritic disease under consideration, but modified by its attacking the last phalanges of the fingers. When it has advanced to some extent, anchylosis more or less complete ensues, the ends of the bones appear enlarged and all the surrounding structures thickened and indurated. It frequently troubles elderly people, and is often attended with some affection of the hip or other large joint. Fig. 24 represents a hand in which the ends of several of the fingers are altered in the manner just described, and some of the joints flexed and immoveable. This form of the disease is often unaccompanied with pain, at least to any inconvenient amount, but there is frequently some tenderness when pressure is used upon the swollen joint.

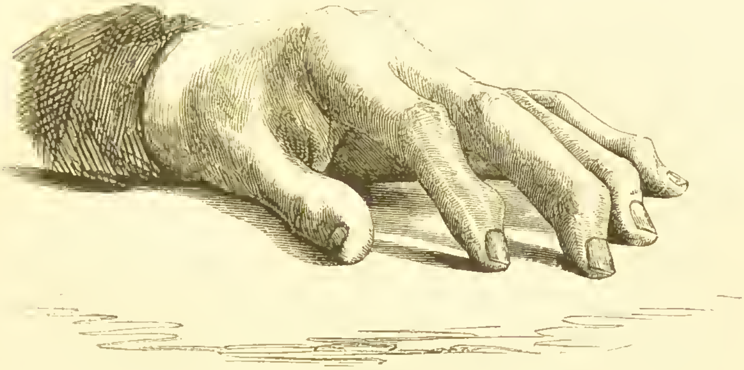


Fig. 24.*

The morbid anatomy of the disease has been carefully studied by pathologists, but especially by Dr. Adams, whose results I will endeavour to give in a small compass.

The fibro-synovial structures of the joints are much altered, the capsules distended with synovial fluid, and exhibit signs of chronic inflammation; the synovia afterwards becomes absorbed, leaving the capsular membrane much thickened. The internal structures—as the round ligament in the hip-joint, the tendon of the biceps in the shoulder—become destroyed, and sometimes entirely removed. When the disease has been long in a joint, the articular cartilages are absorbed, and in certain very old cases even the interarticular cartilages; this is seen in the knee-joint, the wrist, and the lower jaw. From the amount of distension caused by the fluid in the early stages, the different ligaments become elongated, and are slow to recover their natural state, and the joints are thus rendered mobile and more subject to dislocation.

---

* Fig. 24. Hand of a lady, with nodules and distortions induced by rheumatoid arthritis.

Foreign bodies of varying size and consistence are of frequent occurrence; sometimes they are cartilaginous, sometimes bony, and they are connected with the structures of the joint by ligamentous bands; vascular excrescences are likewise common.

* When the articular cartilages have been completely removed, their place is supplied by an ivory-like enamel, remarkable for its polish and hardness; in some joints this covers the entire end of the bone, in others in streaks or patches in the direction of the movement of the joints. The denuded surfaces become partly worn away, and a smooth enamel is formed by the mutual action of the bones on each other, and around the articular surfaces, thus acted upon, bony vegetations arise.

In most joints after the fluid has become absorbed a crepitus is felt on movement, from the rough surfaces grating against each other.

Rheumatoid arthritis or rheumatic gout is often induced or excited by the same causes which lead to acute rheumatism, more especially cold, moisture, and depressing agencies. It appears also to be occasionally excited by the occurrence of acute rheumatism, which seems in certain cases to cause the joints to take on this particular form of action; but an error is apt to occur in our estimation of this influence, inasmuch as it is probable that this variety of arthritis, when it assumes a more than usually severe character, is apt to simulate, and be mistaken for, rheumatic fever. That the sudden production of debility will occasionally give rise to it I have seen many examples, especially in women after severe hemorrhage and rapid child-bearing; it also occurs in young females when labouring under catamenial irregularity. In many cases, however, rheumatoid arthritis arises without evident cause, but generally in patients having weak circulation, even though accompanied with fulness of habit. Our positive information of the intimate nature of this form of arthritis is exceedingly slight; no proof has yet been afforded that there is a morbid principle present in the blood, or that any alteration in its composition has ensued; in several instances I have sought in vain for uric acid, and have generally found an absence of any specific alteration in the urine. The changes in the inflamed structures are also completely different from that which occurs either in gout or rheumatism; for deposits of urate of soda are never produced, but in lieu of this, ulceration of the articular cartilages and alterations in the osseous tissues ensue, which do not result from true gouty inflammation.

It may be that the peculiarities of this form of disease depend rather on the tissues affected than the presence of a morbid matter in the fluids; it may be a form of ulceration and disintegration from deficient nutrition in these slightly vascular structures. The whole subject requires a searching investigation.

Rheumatoid arthritis, or the so-called rheumatic gout, may be distinguished both from gout and rheumatism by many characteristic signs. Haygarth, who, as before stated, terms the disease nodosity of the joints, says: "The nodes appear most nearly to resemble gout; both of them are attended with pain and swelling of the joints, but they differ essentially in many distinguishable circumstances. In gout, the skin and other integuments are generally inflamed, with pain, which is very acute, soreness to the touch, redness and swelling of the soft parts, but in no respects like the hardness of bone. The gout attacks the patient in paroxysms of a few days, weeks, or months, and has complete intermissions, at first for years, but afterwards for shorter periods. The gout attacks men much more frequently than women. There is one distressful circumstance which distinguishes this disorder; it has no intermission and but slight remissions, for during the remainder of the patient's life the nodes gradually enlarge, impeding more and more the motion of the limb; the malady spreads to other joints, without leaving or producing any alleviation in those which had been previously attacked."

To this diagnosis of Haygarth, which is for the most part correct, many additional points of difference might be mentioned. Thus, as regards the seat of the affection at its first invasion, gout attacking the ball of the great toe, the other disease any joint indiscriminately; the one often leading to the formation of chalk-stones, the other never so doing; the character of the blood in the two affections is likewise widely different, as also the pathological changes produced in the injured joints.

Between rheumatism and this form of arthritis there is generally a greater resemblance, but still many diagnostic phenomena can be detected, as will be observed in the accompanying tabular arrangement (p. 544) that I have drawn up, to show at a glance the characteristic differences of the three diseases which have engaged our attention.

Lastly, as to the treatment of rheumatoid arthritis. It must be confessed that in this department much is still to be desired, but at the same time great good can be accomplished by judicious means. We must not attempt to treat it as gout, for colchicum is usually injurious, and a sparing diet far from beneficial. Nor must we deal with it as with simple rheumatism, for the alkaline treatment so serviceable in the latter is sometimes prejudicial in the former.

My own experience enables me to state that much injury is frequently produced in this disease by treatment directed by a wrong view of the nature of the case, and especially from its being confounded with gout or rheumatism.

In rheumatoid arthritis we must pay particular

Table exhibiting the Differential Diagnosis of Gout, Rheumatism, and Rheumatoid Arthritis.

Gout.	Rheumatism.	Rheumatoid Arthritis, or Rheumatic Gout.
Strongly hereditary.	Less so than gout.	Less so than gout, if at all.
Much more frequent in males.	As frequent in females.	More frequent in females.
Seldom occurs before puberty, generally much later.	More frequent in the young, and before middle age.	Occurs both in young and old.
Induced by high living, wine and malt liquors.	Occurs in the weak, and not caused by wine, &c. ; excited by cold and damp.	Often induced by depressing causes, and sometimes excited by cold.
One or more of the smaller joints particularly affected in early attacks, and especially great toe.	Large joints more affected than small, usually several in number.	Large and small joints about equally affected.
Great pain, edema, and desquammation of cuticle.	Pain less intense ; seldom edema.	Less pain ; much swelling, and often some edema.
Does not induce acute inflammation of the structures of the heart.	Often causes acute pericarditis and endocarditis.	No tendency to cause heart disease.
Febrile disturbance moderate.	Febrile disturbance great ; more than from local inflammation.	Little febrile disturbance.
Paroxysms periodic in early attacks.	Attacks not periodic.	No periodicity.
Early attack lasting but a week or ten days.	Attacks generally much longer.	Duration of attacks indefinite.
Blood rich in uric acid.	No uric acid in blood.	No uric acid in blood.
Constant deposit of urate of soda in inflamed cartilages and ligaments.	No deposit of urate of soda.	No deposit of urate of soda ; ulceration of cartilages.
Often leads to kidney disease.	No tendency to cause kidney disease.	No tendency to induce kidney disease.
Often produces chalk-stones externally.	Never causes chalk-stones.	No chalk-stones produced, but swelling of joints.

attention to the general health, and for this purpose keep the different functions in a healthy state, but always by mild remedies. Our great object should be to strengthen and give tone to the system, and for this purpose the proper assimilation of the food is of vital importance ; hence bitters and other tonics are of much service, sometimes combined with ammonia or with a few drops of a mineral acid.

As to special remedies administered with the view of correcting the morbid action going on in the joints, guaiacum, when borne by the stomach, is of great assistance, and should be steadily persevered in, sometimes with the addition of small doses of the iodide of potassium. In some forms of the affection, especially in weakened and spare habits, cod-liver oil is productive of great benefit, given by itself or combined with tonics, which may consist of bark and quinine, or occasionally some form of iron. Our object being to restore tone, and as this want of tone may depend on various causes, so also must the tonics be adapted to the individual case.

Mineral waters have frequently been resorted to in rheumatoid arthritis, but I have seen great disappointment, and sometimes mischief, result from their employment, arising in many instances from their injudicious selection and from mistaking the true character of the disease. If the more powerful waters, as those of Vichy or Carlsbad, are employed, the system becomes lowered and the affection increased, and no good can be afforded by such treatment.

The waters most beneficial are those which tend to restore the tone of the system, more especially the ferruginous waters of Schwallbach, Spa, and Tunbridge; these, combined with the accompanying change of air and freedom from care and business, will often be attended with great advantage, and arrest the progress of the disorder.

The local treatment of rheumatoid arthritis must not be overlooked. The disease is inflammatory, though peculiar in its character, and in the early stages the question of the propriety of depletion naturally arises; in some instances a few leeches may be applied with advantage, and moderate counter-irritation is often of great service, produced by painting the part with tincture of iodine, or by the use of a blister or croton oil. Rest should be enjoined at first, in the hope of thereby aiding the subsidence of the inflammation; but when the alteration in the joints has advanced so far as to forbid all ideas of saving the more delicate structures, then a moderate amount of movement is not only not injurious, but beneficial, as it tends to prevent a rigid state of the articulations.

As, even in the advanced stages, great increase of discomfort may arise from a temporary congestive or sub-inflammatory state of the parts, small doses of iodide of potassium, with the other remedies to keep up the health already mentioned, will sometimes afford relief. I have known patients after having suffered many years from great pain and complete crippling, recover the use of their limbs to a considerable extent upon the occurrence of a marked change of constitution and improvement in the general health.

In rheumatoid arthritis, although the prognosis is unfavourable as to perfect recovery, or the restoration of joints seriously implicated, it still is by no means so as far as life is concerned; and this is more especially true, if the patient be in easy circumstances and not exposed to the influence of depressing causes.

From what has now been advanced it will be seen, that our knowledge of this form of rheumatic gout is by no means equal to that which we possess concerning genuine gouty affections, and this ignorance probably depends on its study having as yet been very imperfect. Dr. Adams, in explanation of this fact, makes the following appropriate and judicious remarks, with which we will conclude the notice of this disease:

"When the affection has become more generally understood and distinguished from gout and rheumatism, properly so-called, and the results of experience faithfully recorded, then, and not till then, will the physician be enabled to speak more positively as to the general medical treatment both of the local and constitutional forms of chronic rheumatic arthritis."

Diseases in connection with the Gouty Diathesis.—As we have shown that it is essential for the production of gout, that uric acid should be present in the blood, although something more is necessary to cause an inflammatory attack, it follows that the gouty and (so-called) uric acid diathesis must necessarily be the same, and we should expect to find gouty patients frequently exhibiting the signs and symptoms commonly resulting from the presence of such diathesis, more especially exhibited in the passing of uric acid, or urate of soda, or ammonia, constituting various crystalline or amorphous sands and calculi; the voiding of uric sand by gouty patients, during some period of their life, is exceedingly common, the formation of calculi by no means unfrequent; as a rule, when in early life gravel and calculi are formed, in after years gout developes itself. It will be remembered that Sydenham himself laboured under these combined miseries, and in explanation of the co-existence of the two diseases, remarks: "Gout produces calculus in the kidneys, which may arise either from the patient lying so long on his back, or from the secreting organs having so long omitted their functions, or the calculus itself may be a part and parcel of the morbific matter. Be this as it may, the patient is frequently at a loss to know if the stone or gout be the worst disease." Morgagni likewise considered that calculi of the kidneys was often joined with gout, and relates an instance in which both kidneys were distended from the presence of such concretions. Sir C. Scudamore did not think that there existed much connection between gout and calculus, remarking, that in five hundred patients, only five were so afflicted;

still, he qualified his statement by saying that in many cases he had seen concretions discharged from the urethra of considerable size.

I have met with several instances of the occurrence of gout and calculus in the same individual, although but few in which they were present at the same time. In these cases, the calculi are usually composed of uric acid or urate of ammonia or soda, but it is not uncommon to find oxalate of lime, either by itself or alternating with the urates. Oxalate of lime is likewise frequently present in the urine in the different forms represented in Plate VI., fig. 8, *a*, *b*, *c*. This is not to be wondered at, as uric acid is so easily decomposed into oxalic acid, and the latter is always present in blood which contains an abnormal amount of the former, as I have proved by repeated observations. It is also capable of being obtained from the secretion of the skin in the same subjects.

As the kidneys are prone to become contracted in chronic forms of this disease and thereby lose much of their excreting power, it follows that the secondary disorders commonly resulting from such a cause, must necessarily be found among the sequelæ of gout. One of the most frequent of these is edema, confined to the legs or of a more general kind; effusions into the cavities are likewise found, constituting ascites, hydrothorax or hydropericardium, in some cases, depending on a low form of inflammatory action of the serous membranes, but sometimes on passive effusion. Epilepsy, apoplexy, and paralysis are not unfrequent, and in short, all the secondary effects of chronic albuminuria are observed in different cases of gout. Many of the above disorders occurring under such circumstances are considered as instances of *misplaced* gout, but a strict pathology will scarcely allow of their being thus classified, although they are intimately associated with the gouty diathesis.

The long continuance of a depraved condition of blood also leads to fatty degeneration of some of the tissues, and this is frequently observed in the heart, and may prove the cause of a fatal termination. It is also seen in the osseous tissue, and I have found the ends of the bones, in extreme cases, very brittle, and containing a large quantity of oleaginous matter.

As gout leads to other maladies, so it has been supposed by some that its presence is antagonistic to the occurrence of certain diseases, and it has been asserted that gout and phthisis stand in this relation to each other. The reason why these disorders are not frequently met with in the same individual is not difficult to explain, seeing that gout is a disease of middle and advanced life, whereas phthisis is more frequently met with in young people. A few cases of their coexistence have come under my care, and I could not in any of them detect that the former disease exerted any controlling power over the latter. In the instance of a young man, phthisis ran a rapid course, although gout was so developed as to have caused the production of extensive chalk-stones.

Prognosis of Gout.—When a patient otherwise in good health is suffering from a fit of regular gout, however severe, the prognosis, as far as the attack is concerned, may be considered favourable. I have never known or heard of an instance which terminated fatally. It was a popular belief, until a very recent period, that the occurrence of gout was rather desirable than not, that in fact it possessed the power of curing every other ailment and of freeing the system from any lurking malady. That such is not the case I have no hesitation in affirming, and I cannot too strongly deprecate the treatment occasionally pursued, of endeavouring to induce an attack of gout for such an ideal purpose. Gout has a decided tendency to shorten life, and insurance companies, being fully aware of the fact, are not backward in acting upon it by increasing the amount of premium for the insurance of the lives of those who have suffered from the disease.

When once a patient has suffered from a fit of gout, he is liable to a recurrence; the interval may indeed be prolonged, even to many years, by great care and attention, but still, except under peculiar circumstances, a return may be expected.

In looking over the histories of the cases which have come within my own knowledge, I can find but few exceptions. An interval of two years often occurs between the first and second attack; this is soon reduced to one year, then to every half-year and so on, as the disease becomes more and more grafted into the constitution. These remarks apply to such as take no care to prevent its return. If proper precautions be taken, and an appropriate plan devised and followed out, a very different course may be given to the disease, even when it has acquired some considerable hold upon the system. The following are a few exceptions I have met with :—

A gentleman, now seventy, had an attack of gout in the ball of the left great toe when thirty-five years of age. From the latter date, up to the present time, he has been accustomed to live well, and has partaken freely of port wine, but has had no return of the affection.

Another gentleman, twenty years of age, a medical student, in the spring of the year was attacked about ten o'clock in the morning with excruciating pain in the ball of the great toe. This lasted five or six hours, and left the part so swollen and tender, that he was unable to resume his studies for six days. Thirteen years after he had an attack in the ankle, apparently brought on by over walking and taking some stout. It is now more than eighteen years since this last attack, and he has had no return, but occasionally feels darting pains through the joints of the great toes.

This gentleman's father had gout for the first time at 68 years of age, the year in which he died.

Gouty patients sometimes live to a good old age, and occasionally, in the latter part of their lives, the fits become milder and less frequent. A few years since I met with an example of this in a gentleman then about 84, who had suffered from gout for 50 years. No chalk-stones were visible, and his general health had been remarkably good; during the ten years previous to my seeing him, although he still suffered occasionally from gout, yet the fits had become much less frequent and of milder character. I have met with other similar instances, but am inclined to think that they are somewhat exceptional.

After repeated visits, when the disease takes an asthenic and chronic character, and more especially when any crippling of the joints occurs, or deposits become visible, it will generally be found that the kidneys have lost much of their uric acid-excreting power, and the urine contains a trace of albumen, the blood at the same time being loaded with urates; in these cases the prognosis is much less favourable, for though such patients may live many years under favourable circumstances, still they are liable to be seriously affected by intercurrent disease, severe accidents, and other agencies, which in healthy subjects would be unattended with dangerous consequences.

One gentleman, about 54 years of age, who had inherited gout very strongly, was attacked with the disease early in life; before the age of 35 he had noticed chalk-stones, and in a short time was much crippled, both in the hands and feet, many of the smaller joints of which were partially anchylosed. The urine was pale, and contained but a minute trace of uric acid. One autumn, when at the sea-side, after exposure to cold, in place of having ordinary catarrhal symptoms, he rapidly sank, apparently from prostration of the vital powers.

Another case was that of a tall and robust man, who had suffered from gout for many years, and had concretions about the extremities, as well as several nodules upon the ears; after a severe accident, fracture of the thigh, he progressed favourably for a few days, but died suddenly, and without apparent cause. At the *post mortem* examination I discovered the kidneys to be very small and contracted, and weighing only about two and a half ounces each; tho tubuli of the pyramidal portion contained white streaks of urate of soda, and the organ presented an appearance resembling that shown in Plate IV., fig. 2, *a*, *b*.

In the chapters on Morbid Anatomy, and in Appendix A, other examples will be seen proving the liability of gouty subjects to be suddenly cut off by slight accidents; and it is probable that the fatal termination in such cases is dependent on the state of the kidneys, which are capable of performing their functions but imperfectly under ordinary circumstances, but quite unable to do so when an increased demand is made upon them.

That even comparatively slight injuries are accompanied with a considerable waste of tissue, and the necessity for increased elimination, I have proved by the examination of the urine of a patient under the effect of a large blistered surface. The amount of the solid excretion of the urine was found almost double, compared with what it had been for some time previously, and with this increased elimination there was a considerable diminution in the weight of the body; it is probable that an increased waste likewise takes place after severe injuries, and in febrile disturbance from any other cause.

Besides being affected by acute disease and accidents, such patients are also liable to the occasional supervention of that form of gout which has been named retrocedent, and this metastatic action, whether to the heart, stomach, or brain, may be accompanied with much danger; and, moreover, in chronic gout, the blood remains impure even in the interval of the attacks, giving rise in many cases to constant dyspepsia, and hence, indirectly, tending to an imperfect nutrition of the body, a condition of habit which may be termed gouty cachexia, and the production of organic disease in various important organs.

The examination of the urine for the purpose of ascertaining how far the function of the kidneys has become implicated, is of much value as an aid to prognosis in many cases of gout.

In concluding my remarks upon this subject I may state, that I consider even a single fit of gout, however slight, should be looked upon as an intimation that the patient cannot go on with impunity in his then habits of living; a warning that either he must change them, or expect returns of the disease, which are certain to increase both in frequency and duration, and likely, if no heed be taken, to embitter and shorten existence.

On the other hand, I am equally persuaded that if proper regimenal and medicinal precautions be taken, the gouty patient may be saved from such a termination, and that the disease, in place of increasing in severity, may be gradually mitigated, and probably interfere but little with the comforts of life.

APPENDIX.

(A.)

Further Observations on the Morbid Anatomy of Gout.

(Continued from Chapters VI. and VII.)

At the end of Chapter VII. we gave a short account of a tenth case of gout in which an examination had been made after death, which was caused by a severe accident. All the phenomena then found confirmed what we had before observed, as to the condition of the joints and also of the kidneys. Since that period the subject has continued to occupy my attention, and I have had further opportunities not only of verifying the results previously arrived at, but even of proceeding a step further, as will be seen in the sequel.

Case 11.—May, 1859. A man 37 years of age, a butcher by trade, and not inheriting gout, but had suffered from it for ten years, first in the great toes, and afterwards in the ankles, knees, and wrists; of late he has had as many as three or four fits annually. His death arose from a severe attack of peritonitis. For some time he had suffered from much difficulty of breathing, and the urine was albuminous during his final illness. For the last six months he had not been troubled with gout. Not the slightest trace of external deposits of urate of soda were observed, not even a speck on the ears, nor was there any deformity or stiffness of the joints.

On opening the metatarso-phalangeal joints of each great toe, the cartilages of the bones, including the sessamoid, were found much encrusted with a white deposit of urate of soda, some white matter also seen in the ligamentous structures. The phalangeal joints were perfectly free from the disease.

A very slight streaking was observed in the right knee-joint and on the condyles of the femur and surface of tibia, but none in right elbow; the other articulations were not examined.

The left kidney was short and thick, capsule very opaque and adherent, and, on attempting to remove it, the surface of the cortical substance was much injured, and exhibited a granular appearance. Weight, five ounces avoirdupois.

The right kidney similar in appearance to the left, but with a large cyst on its surface, extending into the cortical structure. At the end of the pyramids of both kidneys white points were observed, and many streaks along the course of the tubuli uriniferi; the points and streaks exhibited a crystalline structure under the microscope, and were composed of urate of soda.

Case 12.—August, 1859. J. S., a man, aged 59 years, who died from the effects of an accident. The circumstances connected with the case were as follow: He was thrown down by a cab, which caused some injury to the right knee, and a bruise of a slighter character in the left foot. Gangrene occurred in the right leg, which made it necessary to have recourse to amputation of the thigh; the stump, however, became affected in a similar manner, and the patient soon died from exhaustion. From the history of the case obtained from his wife, it appeared that he had been subjected to occasional attacks of gout for the last ten years, affecting principally the great toes and ankles, and now and then a joint of the upper extremities. He had also experienced one slight attack in the left knee.

The pathological appearances discovered after death, as far as the gouty affection was concerned, were as follow:

The cartilages on the head of the metatarsal bone and first phalanx of the right great toe were encrusted with urate of soda over more than half the extent of their surfaces, and some deposit was present on the sessamoid bones; specks of the same matter were likewise seen on the inner surfaces of the ligaments. The left great toe was similarly affected, but in a somewhat slighter degree, and the ankle bones of the same side exhibited white patches of the salt; no trace of deposit was found in the right knee-joint. As it had been previously ascertained that the patient had experienced *one slight attack* of gout in the left knee, it became a matter of extreme interest to observe the condition of this joint, and ascertain whether any appearances remained from the occurrence of this slight affection, which had taken place some years previous to his death. No deposit was observed on the surfaces of the tibia articulating with the condyles of the femur, the inner condyle of this latter bone was likewise free, but on the anterior portion of the outer condyle a small patch was seen, not exceeding a sixth of an inch in breadth, and about half an inch in length, the deposit gradually becoming less dense from before backwards. In the notch between the condyles a very small spot was likewise seen. A speck about the size of a peppercorn was found near the tuberosity on the outer side of the external condyle, connected with the lateral ligaments. A considerable amount of urate of soda was found on the articulating surface of the patella, almost entirely confined to the outer half; a portion of this was very superficial, but some deep seated in the cartilage, approaching close to the osseous tissue. In the ligamentous structures upon the outer surface of the patella, minute specks of the same salt were visible; these appearances are delineated in fig. 25. The only other morbid phenomenon presented by the joint were a few scattered and very small white points upon the under surface of the internal semi-lunar cartilage, but too small to be exhibited in a woodcut; the crucial ligaments were quite free.

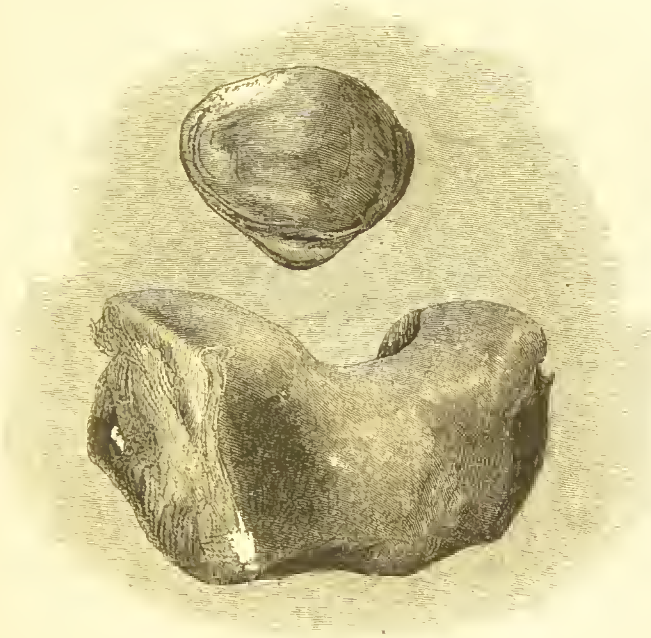


Fig. 25.*

Both kidneys were small and pale; the right weighed three ounces, the left two ounces and three-quarters. On removing the capsules, the surface presented a granular appearance, and on section, the cortical substance was found to be wasted. A deposit of crystalline urate of soda in the form of spots and streaks was seen at the mamilla of each pyramid,

---

[*] Fig. 25. A knee-joint, showing the deposition of urate of soda resulting from one slight attack of gout.

and in the direction of the tubuli. No opportunity occurred to examine the urine of this man.

These additional cases will be seen to add strength to the conclusions before arrived at, and the last affords an absolute proof, if any be wanting, that gouty inflammation is *invariably* accompanied with a crystalline deposit of urate of soda, as we had full evidence that the knee in question had only been once affected, and then but in a slight degree.

Since Chapter VIII. passed through the press, the subject of deposits in the kidneys has engaged my attention, and I have been much assisted by Mr. W. Hickman, late physician's assistant, now house surgeon to University College Hospital, who has carefully examined these organs in twenty-three consecutive autopsies; the object of which was to ascertain if the white points and streaks were found in other than gouty cases. The examinations were necessarily made on subjects who had died of very varying causes, some from accidents, but most from disease; one individual had suffered from gout, and here the deposits were discovered, as also the affection of the joints; in nineteen out of the twenty-two remaining cases, no deposits of urate of soda were discovered, but fatty matter was occasionally observed among the tubes; in three, however, in whose joints no evidence of gouty deposit was visible, crystals were seen in the kidneys, some composed of uric acid, others of urate of soda, but situated within the tubes, and much larger than those observed in cases of gout, where, as I have before remarked, the deposit often appears to be interstitial, that is, within the fibrous tissues of the kidney, as if true gouty inflammation had occurred in the organ itself. I should not wish at present to make any positive statement on the subject, as I look upon it as still *sub judice*. Although a crystalline deposit is found in other subjects than those who have had articular gout, yet the occurrence is rare: and, besides this, the extent to which it occurs is generally so small as to require a special examination to discover it, whereas, in gouty cases, it is very apparent. Of the above three exceptional cases, two were in males, 70 and 73 years old, the other a female, 68 years of age, who died from a burn.

(B.)

Methods of determining the amount of Uric Acid in the Urine.

(Referred to in Chapter V.)

The method I have usually adopted for ascertaining the amount of uric acid in urine is as follows :—A quantity of the urine, a portion of the whole daily amount, is taken, and if free from any urate deposit, filtered, and five or ten fluid ounces accurately measured ; to this some foreign acid, either strong acetic or hydrochloric acid, is added in the proportion of about one part of the acid to twenty of the urine ; the mixed fluids are allowed to stand for forty-eight hours, and then the uric acid which has been deposited, is collected on a weighed filter, washed with distilled water, and afterwards with alcohol, then dried, and the weight ascertained. If any deposit of urates be present, the urine should be heated so as to re-dissolve it, and then the above process pursued. If, however, any crystalline deposit has taken place, this must be collected separately, washed and weighed, and, after proceeding with the clear fluid as above described, the weight of the natural deposit, in proportion as the amount of urine taken for examination is to the whole quantity, must be added to the usual uric acid determination.

If we wish to determine the uric acid in a given quantity of urine only, or to obtain the relation of this body to other constituents of the urine, then 1000 grains of urine may be weighed and the above process followed.

Methods of determining the amount of Urea in Urine.

1st. Dr. Davy's Process.

The method of determining the amount of urea as proposed by Dr. E. W. Davy* is as follows :—A strong glass tube is selected, from twelve to fourteen inches long, closed at one end, and its open extremity ground smooth, with the bore not larger than can be conveniently covered with the thumb. This is to be filled more than a third full of mercury, and afterwards a carefully measured quantity of the urine to be examined, from a quarter of a drachm to a drachm or upwards, according to the capacity of the tube, poured in ; then the tube being held in one hand near its open extremity and the thumb being in readiness to cover the aperture, it is to be quickly and completely filled with a solution of hypochlorite of soda (taking care not to overflow the tube), and then the opening is to be instantly covered with the thumb, and the tube having been rapidly inverted once or twice to mix the urine with the hypochlorite, is to be finally opened under a saturated watery solution of common salt contained either in a steady cup or small mortar. The mercury then flows out, the solution of salt taking its place, and the mixture of urine and hypochlorite being lighter than the solution of salt, will remain in the upper part of the tube, and will thus be prevented from descending and mixing with the fluid in the cup. A rapid disengagement of minute bubbles of gas soon takes place in the mixture in the upper part of the tube, and the gas is there retained and collected. The tube is then to be left in the upright position till there is no further appearance of minute globules of gas being formed, the time being dependent on the strength of the hypochlorite and the quantity of urea present ; but the decomposition is generally completed in from three to four hours. It may, however, be left much longer, even for a day, if convenient, and having set the experiment going, it requires no further attention ; and when the decomposition is completed, it is only necessary to measure the quantity of gas produced by transferring it into a graduated tube or measure. What, however, is more convenient, is to make use of a graduated tube in the first instance, as it saves the trouble of transferring the gas, and the risk of losing some of it. Dr. Davy thinks the most convenient for the purpose is a stout tube having a bore of half an inch in diameter, and capable of holding from two to three cubic inches. A tube of this bore and about fourteen inches in length, will hold two and a-half cubic inches, and will be quite large enough. Each cubic inch should be divided into tenths and hundredths of a cubic inch. When great accuracy is required, due attention must be paid to both temperature and atmospheric pressure.

---

* Philosophical Magazine, Fourth Series, No. 47, June, 1854.

The reaction explaining the process of decomposition may probably be thus represented :—

One equivalent of urea and 3 equivalents of hypochlorite of soda are resolved into 2 equivalents of carbonic acid, 4 of water, 3 of chloride of sodium, and 2 of nitrogen, or

$$C_2N_2H_4O_2 + 3\ (NaO,\ ClO) = 2\ (CO_2) + 4\ (HO) + 3\ (Na\ Cl) + N_2.$$

The carbonic acid gas is dissolved by the fluid in the tube, especially the excess of the alkaline hypochlorite, but the nitrogen gas being almost insoluble remains for measurement.

The fifth part of a grain of urea should furnish by calculation 0·3098 parts of a cubic inch of nitrogen gas at 60° Fahr., and 30 inches Bar. ; Dr. Davy found the quantity yielded by the above method in two experiments to be 0·3001 and 0·30069 parts of a cubic inch at the same temperature and pressure, which shows that the calculated quantity of nitrogen differs from the amount obtained by only a few thousandths part of a cubic inch, and the experiments were made in a tube too small for the purpose.

Assuming then that a $\frac{1}{5}$ part or 0·2 grain of urea gives 0·3098 parts of a cubic inch of nitrogen gas, or 1 grain gives 1·549 cubic inch, we have the following equation :

$$\text{Quantity of urea} = \frac{\text{Quantity of gas yielded in cubic inches}}{1{\cdot}549}.$$

Dr. Davy compared the results obtained by his method with those obtained by Liebig's process, using different samples of urine, and in three experiments the results were as follows, in which the amounts of urea containing the fluid ounce of urine are indicated.

	Liebig's Process.	New Method.
1st Experiment . . .	3·680 grains . .	3·712 grains.
2nd ,, . .	5·328 ,, . .	5·472 ,,
3rd ,, . . .	4·976 ,, . .	4·976 ,,

In the first and second experiments the quantity of common salt contained in the urine was taken into account when Liebig's process was made use of ; this diminishes somewhat the quantity found. In the third experiment it was omitted.

Dr. Davy makes certain remarks as to the value of the method and the precautions which should be taken in order to ensure correct results.

The hypochlorite of soda is preferred to either the hypochlorite of potash or lime ; its advantage over the former consists in its being kept by chemists and known in pharmacy as liquor sodæ chlorinatæ, and has not therefore to be specially prepared ; and it does not soil the sides of tubes as the lime salt would do from the formation of the carbonate of lime, and besides which this latter salt is much less fitted for the purpose.

The hypochlorite of soda should always be used in excess, five or six times the volume of the urine employed will generally be found quite sufficient to ensure this. If there exists any doubt as to this point, it may be readily determined by direct experiment, by adding to a certain quantity of the urine to be examined, a measured amount of the hypochlorite solution, and then leaving it for a short time till the evolution of gas is nearly over ; then, if on the addition of more of the hypochlorite, the effervescence is renewed, it shows that there was not enough of the decomposing liquor first employed, and more must be added from time to time till no further evolution of gas is produced, and the quantity of the hypochlorite used to urine at this point indicates the amount necessary.

One grain of urea requires about half an ounce of the ordinary liquor sodæ chlorinatæ for its complete decomposition. The amount of mercury employed requires some little attention. It should not be less than the volume of the gas produced ; for if the volume of gas evolved be more than that of the mercury, it will be necessarily more than that of the solution of salt, and consequently some of the mixture of urine and hypochlorite will be forced out, and some gas by this means lost. Should this occur at any time, the experiment should be repeated, and a larger quantity of mercury or smaller quantity of urine made use of.

No gas need be lost during the pouring of the hypochlorite into the tube, if proper care is taken, as several seconds usually elapse before any apparent reaction or evolution of gas ensues. From my own experience, I find a great difference in this respect in different urines, doubtless arising from the partial decomposition of the urea and the formation of an ammonia salt. The longer the urine is kept, the more quickly the evolution of gas takes place, as urea is not so rapidly acted upon by the hypochlorite as ammonia salts; however, this is but of slight importance, for the same quantity of nitrogen would be evolved should a part of the urea have been thus previously decomposed.

Uric acid also gives rise to the evolution of nitrogen gas when acted upon by hypochlorite of soda, but this error is not likely to be of moment, as when present in large amounts, it becomes deposited, and may be separated by filtration or decantation, especially if the urine be acid in reaction, and if not, the addition of a few drops of some acid will cause its almost entire precipitation. Dr. Davy thinks that Liebig's recommendation of heating the urine gently with some baryta water as long as the vapour of ammonia is disengaged, and thus separating not only the ammonia but also the greater part of the uric acid, might sometimes be made use of with advantage before having recourse to his method.

I have found that creatine also gives rise to the evolution of nitrogen when treated with the hypochlorite of soda; creatinine would probably do the same, but the amount of these principles is small, and would lead to no serious error. Should albumen be present, it should be removed previous to the determination of urea. The presence of sugar and colouring matters would not influence the result.

One source of error, which can readily be avoided, may arise from allowing the hypochlorite of soda in the tube to be exposed to a strong light for several days, as a little oxygen may by this means be given off, but one or even two days' exposure will scarcely affect the result.

2nd. Liebig's Process.

Principle of the Process.—When a solution of urea is added to a solution of pernitrate of mercury, an insoluble compound is formed which consists of one equivalent of nitric acid, four of peroxide of mercury, and one of urea. The quantity of pernitrate of mercury required to precipitate the whole of the urea enables us to estimate the urea contained in a given quantity of urine.

Preparation of the Test Fluid.—100 grammes = 1544 grains of distilled mercury are dissolved in nitric acid, and the solution is evaporated to a syrup, nitric acid being added from time to time until no red fumes are given off, and until no turbidity is produced by a solution of common salt. Warm water acidulated with nitric acid is now added, until the whole occupies 1400 cubic centimetres or 49·5 fluid ounces. One cubic centimetre contains ·772 gramme of peroxide of mercury, which is sufficient to precipitate ·001 gramme of urea, leaving a slight excess of pernitrate of mercury undecomposed, which gives a yellow stain on the addition of a solution of carbonate of soda.

Preparation of the Urine.—It is necessary to remove sulphuric and phosphoric acids, which would otherwise form precipitates with the pernitrate and apparently augment the proportion of urea. They are removed by means of a baryta solution consisting of one volume of saturated solution of nitrate of baryta and two volumes of baryta water. By means of graduated pipettes one volume of this fluid is mixed in a beaker with two volumes of urine, but in case the specific gravity of the urine exceeds 1025 it is better to mix equal volumes of the two liquids; whilst if the specific gravity be very low it is not necessary to add more than one-fourth of the baryta solution. The mixed fluids are now thrown upon a *dry* filter, and the clear liquid must be tested with a drop of baryta fluid to ensure the total precipitation of the sulphuric and phosphoric acids.

Testing the Prepared Urine.—A quantity of the prepared urine equal to 10 cubic centimetres of the original secretion is first poured into a glass beaker. Thus if 20 c. c. of urine have been added to 10 c. c. of baryta solution, we take 15 c. c. of the filtered fluid. We then fill a burette graduated to 50 c. c. with the mercurial test fluid. Lastly, we prepare a white plate by dropping upon it a solution of carbonate of soda. We now permit the test fluid to drop into the prepared urine, constantly stirring by a revolving motion of the beaker. A considerable precipitate is immediately formed, which increases in bulk until the whole of the urea is thrown down. We now take out a drop of the fluid under examination by means of a pipette, and we allow this drop to fall upon the plate prepared with the carbonate of soda. If the precipitate remain white, more of the mercurial test fluid must be added, but as soon as a *distinct yellow spot* is formed the operation is completed. The number of cubic centimetres consumed represents the proportion of urea in 1000 parts by volume. Thus, if we find the yellow spot to have been produced by the addition of 30 c. c. of the mercurial solution, 10 c. c. of the urine have yielded ·030 gramme of urea, or 1000 parts by volume have given 30 grains.

Four circumstances interfere with the exact accuracy of the result.

First. No urea deposit is formed by the mercurial test fluid until all the chloride of sodium present in the urine has been converted into bichloride of mercury. The amount of urea is thus apparently increased, and we must deduct 1 c. c. in urine of low specific gravity, 1·5 c. c. in urine of moderate sp. gr., and 2 c. c. in urine the sp. gr. of which exceeds 1025.

Secondly. When the amount of urea is small, more of the mercurial solution is added than is required for precipitating the urea, in order to make the yellow spot quite visible. We must therefore deduct one milligramme for every 5 c. c. less than 30 c. c. of the fluid used. Thus, if the yellow spot be formed when 20 c. c. of the test fluid have been added, the real amount of urea will not be 20, but 19·8 per 1000.

Thirdly. When the amount of urea exceeds 3 per cent., the yellow spot is formed before the precipitation of all the urea, for the solution becomes strongly acid and a portion of the urea compound is held in solution. We must, therefore, add a little water when more than 30 c. c. of mercurial fluid have been added to 15 c. c. of the prepared urine. For every 10 c. c. of test fluid above 30 c. c. we must add 5 c. c. of distilled water before we apply the test by carbonate of soda.

Lastly. Free ammonia produces a deposit with the pernitrate. It is, therefore, necessary to employ fresh urine, and it is well to acidify the prepared urine with dilute nitric acid, which prevents the deposit by ammonia when the test fluid is added, whilst it does not materially interfere with the urea determination. When the quantity of ammonia is considerable, it is best to determine its amount by a separate process.

(C.)

Analyses showing the peculiarity of the excretion of Uric Acid in a gouty case, also the influence of Colchicum.

The subjoined analyses, 71 in number, were made on the urine of a male patient, H. C., 51 years of age, who was admitted into the hospital in November, 1852, suffering from chronic bronchitis, accompanied with much difficulty of breathing: in a short time the symptoms were relieved in a very striking manner on the occurrence of a severe attack of gout in the ball of the great toe, which afterwards extended to the side of the foot and knee. About five weeks after, on readmission from another attack of the bronchitis, the examinations of the urine were commenced, the patient at the time having also flying gouty pains in many joints with some tenderness of the affected parts. The results, including the amount of urine passed each day, its specific gravity, and the daily elimination of uric acid, illustrate well the disposition which the kidneys appear to acquire in gout of throwing out the acid in an irregular and somewhat intermittent manner. In the present case the daily amount of this principle will be found to be sometimes as much as eight grains, sometimes as little as two-tenths of a grain. Again, as colchicum was administered during a part of the time, any influence which it may possess in altering the amount of uric acid must be exhibited, and it appears from these results, that it diminished rather than increased its excretion, thus confirming the conclusion which we had previously arrived at. The average of the uric acid during the whole time the patient was under the drug being 1·65 grain, whereas when not taking this medicine it was 2·26 grains.

Date.	Quantity and sp. gravity of the urine.		Uric acid passed in the 24 hours.	Circumstances and state of patients.
1852.				
Nov. 25	98 fl. ozs.	1008	1·96 grs.	No medicine.
,, 26	72 ,,	1012	3·12 ,,	
,, 27	68 ,,	1014	2·72 ,,	Average of uric acid passed per diem=2·70 grs.
,, 28	60 ,,	1013·5	3·00 ,,	
,, 29	68 ,,	1010	1·81 ,,	Vinum Colchici, M. xx. ter. in die.
,, 30	66 ,,	1011·5	2·20 ,,	
Dec. 1	64 ,,	1011·5	2·13 ,,	
,, 2	72 ,,	1007	0·36 ,,	Average of uric acid passed per diem=1·39 gr.
,, 3	66 ,,	1011	0·44 ,,	

Date.		Quantity and sp. gravity of the urine.		Uric acid passed in the 24 hours.	Circumstances and state of patients.
1852.					
Dec.	4	68 fl. ozs.	1010	1·13 grs.	Vinum Colchici. M. xxx. ter. in die. Average of uric acid passed per diem=1·27 gr.
,,	5	64 ,,	1010	0·64 ,,	
,,	6	68 ,,	1010·5	1·70 ,,	
,,	7	76 ,,	1010	1·77 ,,	
,,	8	72 ,,	1011	0·48 ,,	
,,	9	70 ,,	1011	0·47 ,,	
,,	10	46 ,,	1012	1·38 ,,	
,,	11	50 ,,	1010·5	1·00 ,,	
,,	12	47 ,,	1012·5	2·82 ,,	
,,	13	45 ,,	1012	1·65 ,,	No medicine.
,,	14	37 ,,	1014	1·85 ,,	
,,	15	51 ,,	1009·5	1·02 ,,	
,,	16	45 ,,	1010	0·90 ,,	
,,	17	37 ,,	1011·5	1·35 ,,	
,,	18	54 ,,	1007	0·27 ,,	
,,	19	46 ,,	1010	0·15 ,,	
,,	20	57 ,,	1009	0·19 ,,	
,,	21	51 ,,	1015	2·21 ,,	
,,	22	66 ,,	1012	1·81 ,,	
,,	23	49 ,,	1010	0·65 ,,	
,,	24	35 ,,	1013	1·75 ,,	
,,	25	49 ,,	1011·5	2·61 ,,	
,,	26	64 ,,	1008	0·21 ,,	
,,	27	48 ,,	1010	0·64 ,,	
,,	28	61 ,,	1012	1·22 ,,	
,,	29	52 ,,	1013	0·69 ,,	
,,	30	49 ,,	1015·5	0·41 ,,	
,,	31	49 ,,	1012	0·49 ,,	
1853.					
Jan.	1	53 ,,	1015	0·18 ,,	
,,	2	66 ,,	1013·5	4·07 ,,	
,,	3	70 ,,	1011·5	4·08 ,,	
,,	4	51 ,,	1012	3·65 ,,	
,,	5	50 ,,	1011	2·92 ,,	
,,	6	64 ,,	1010	1·28 ,,	
,,	7	48 ,,	1011·5	2·00 ,,	
,,	8	56 ,,	1011	3·17 ,,	
,,	9	55 ,,	1011·5	2·84 ,,	

Date.	Quantity and sp. gravity of the urine.		Uric acid passed in the 24 hours.	Circumstances and state of patients.
1853.				
Jan. 10	55 fl. ozs.	1009	0·18 grs.	No medicine.
,, 11	11 ,,	1030	3·10 ,,	
,, 12	36 ,,	1015·5	3·60 ,,	
,, 13	28 ,,	1018	2·60 ,,	
,, 14	47 ,,	1013·5	2·04 ,,	
,, 15	53 ,,	1011·5	3·53 ,,	
,, 16	43 ,,	1011·5	3·30 ,,	
,, 17	35 ,,	1014·5	5·60 ,,	
,, 18	23 ,,	1019·5	6·20 ,,	Vinum Colchici, ʒss. ter. in die.
,, 19	24 ,,	1022	8·60 ,,	
,, 20	21 ,,	1022	5·70 ,,	
,, 21	50 ,,	1012	5·00 ,,	
,, 22	37 ,,	1008	1·23 ,,	
,, 23	56 ,,	1007·5	1·49 ,,	Average of uric acid passed per diem=3·02 grs.
,, 24	45 ,,	1011	3·45 ,,	
,, 25	52 ,,	1006·5	0·52 ,,	
,, 26	30 ,,	1016	2·00 ,,	
,, 27	59 ,,	1010·5	1·96 ,,	
,, 28	57 ,,	1014·5	4·37 ,,	No medicine.
,, 29	50 ,,	1011	1·17 ,,	
,, 30	58 ,,	1012	0·97 ,,	
,, 31	85 ,,	1007	not determined.	
Feb. 1	45 ,,	1012	0·75 grs.	
,, 2	67 ,,	1012	2·46 ,,	
,, 3	46 ,,	1012	1·69 ,,	

Uric Acid passed in 24 hours :—

Maximum of uric acid	8·60	grs.
Minimum	0·18	,,
Average	1·96	,,
Average without colchicum	2·26	,,
Average under colchicum	1·65	,,

Quantity and Weight of Urine :—

Average quantity of urine passed without colchicum	51	fl. ozs.
Specific gravity	1012·5	,,
Average quantity under colchicum . .	51	,,
Specific gravity	1011·4	,,

(D.)

TABLE OF ANALYSES OF THE DIFFERENT SPRINGS AT VICHY AND THE NEIGHBOURHOOD.

Contents of a litre of water from each source, the weights expressed in grammes. (Referred to in Chapter XIII.)

	VICHY.								HAUTE RIVE.	ROUTE DE CUSSET.
	Grande Grille.	Puits Chomel.	Puits Carré.	Lucas.	Hôpital.	Celestins.	Puits de l'enclos des Celestins. Puits Lardy.	Puits Brosson, du Parc.	Puits d'Hauterive.	Puits de Mesdames.
Free carbonic acid	0·908	0·768	0·876	1·751	1·067	1·049	1·750	1·555	2·183	1·908
Bicarbonate of soda	4·883	5·091	4·893	5·004	5·029	5·103	4·910	4·857	4·687	4·016
,, of potassa	0·352	0·371	0·378	0·282	0·440	0·315	0·527	0·292	0·189	0·189
,, of magnesia	0·303	0·338	0·335	0·275	0·200	0·328	0·238	0 213	0·501	0·425
,, of strontia	0·303	0·003	0·003	0·005	0·005	0·005	0·005	0·005	0·003	0·003
,, of lime	0·434	0·427	0·421	0·545	0·570	0·462	0·710	0·614	0·432	0·604
,, of protoxide of iron	0 004	0·004	0·004	0·004	0·004	0·004	0·028	0·004	0·017	0·026
,, of protoxide of manganese	traces	traces	traces	traces	traces	traces	traces	traces	traces	traces
Sulphate of soda	0·291	0·291	0·291	0·291	0·291	0·291	0·314	0·314	0·291	0·250
Phosphate of soda	0·130	0·070	0·028	0·070	0·046	0·091	0·081	0·140	0·046	traces
Arseniate of soda	0·002	0·002	0·002	0·002	0·002	0·002	0·003	0·002	0·002	0·003
Borate of soda	traces	traces	traces	traces	traces	traces	traces	traces	traces	traces
Chloride of sodium	0·534	0·534	0·534	0·518	0·518	0·534	0·534	0·550	0·534	0·355
Silica	0·070	0·070	0·068	0·050	0·050	0·060	0·065	0·055	0·071	0·032
Bituminous matter	traces	traces	traces	traces	traces	traces	traces	traces	traces	traces
Total	7·914	7·959	7·833	8·797	8·222	8·244	9·165	8·601	8·956	7·811
Temperature	105° Fah.	111° Fah.	111° Fah.	85° Fah.	87° Fah.	55° Fah.	74° Fah.	72° Fah.	58° to 61° Fah.	Cold.

Analysis of the Kochbrunnen Spring, Wiesbaden (Fresenius).

	In 1000 parts.	In the pint (7680 grs.)
Chloride of sodium	6·83565	52·49779 grs.
,, of potassium	0·14580	1·11974 ,,
,, of lithium	0·00018	0·00138 ,,
,, of ammonium	0·01672	0·12841 ,,
,, of calcium	0·47099	3·61720 ,,
,, of magnesium	0·20391	1·56603 ,,
Iodide of magnesium	traces	traces
Bromide of magnesium	0·00355	0·02726 ,,
Sulphate of lime	0·09022	0·69289 ,,
Silica	0·05992	0·46018 ,,
Carbonate of lime	0·41804	3·21055 ,,
,, of magnesia	0·01039	0·07979 ,,
,, of baryta ,, of strontia	traces	traces
,, of protoxide of iron	0·00565	0·04339 ,,
,, of manganese	0·00059	0·00453 ,,
,, of copper	traces	traces
Phosphate of lime	0·00039	0·00299 ,,
Arseniate of lime	0·00015	0·00115 ,,
Silicate of alumina	0·00051	0·00392 ,,
Organic matter	traces	traces
Total solids	8·26266	63·45720 ,,
Carbonic acid, free and combined with carbonates	0·50822	3·90313 ,,
Nitrogen	0·00200	0·01540 ,,

Analysis of the Kaiserquelle (Source de l'Empereur), Aix-la-Chapelle.

TEMPERATURE 135° FAHR.

In 16 fluid ounces there are contained :

Chloride of sodium	20·71	grs.
Carbonate of soda	6·61	,,
,, of lime	0·23	,,
,, of magnesia	0·15	,,
,, of strontia	0·04	,,
Sulphate of soda	2·12	,,
Sulphuret of sodium	0·62	,,
Phosphate of soda	0·14	,,
Fluoride of calcium	0·47	,,
Silica	0·54	,,
Organic animal matter	0·29	,,
	31·92	,,
Carbonic acid	8·00	cub. in.
Sulphuretted hydrogen	0·13	,, ,,
Nitrogen	18·53	,, ,,

Analysis of the Sprudel Spring at Carlsbad.

TEMPERATURE 167° FAHR.

In each 16 fluid ounces there are contained, besides a little dissolved carbonic acid :

Sulphate of soda	19·860	grs.
Carbonate of soda	9·690	,,
Chloride of sodium	7·970	,,
Carbonate of lime	2·370	,,
,, of magnesia	1·360	,,
,, of strontia	0·007	,,
,, of iron	0·020	,,
,, of manganese	0·006	,,
Phosphate of lime	0·001	,,
,, of alumina	0·002	,,
Fluoride of calcium	0·024	,,
Silex	0·570	,,
	41·880	,,

Analysis of the Water of the Hauptquelle, the most saline of the Teplitz springs.

In one litre is contained :

Carbonate of soda	0·384 grs.
,, of lime	0·042 ,,
Chloride of sodium	0·056 ,,

with traces of iron, manganese, magnesia, and silica.

Analysis of the Mineral Water of the chief spring at Wildbad, Würtemberg.

TEMPERATURE 98° FAHR.

In each 16 fluid ounces there are contained, together with small amounts of carbonic acid, nitrogen, and oxygen :

Chloride of sodium	1·82 grs.
Carbonate of soda	0·53 ,,
,, of lime	0·34 ,,
,, of magnesia	0·07 ,,
,, of iron	0·02 ,,
,, manganese	0·02 ,,
Sulphate of soda	0·40 ,,
,, of potash	0·02 ,,
Silex	0·39 ,,
	3·61

Analysis of the Buxton Waters (Playfair).

An imperial gallon at 60° Fahr. contains :

Silica	0·666 grs.
Oxide of iron and alumina	0·240 ,,
Carbonate of lime	7·773 ,,
Sulphate of lime	2·323 ,,
Carbonate of magnesia	4·543 ,,
Chloride of magnesium	0·114 ,,
,, of sodium	2·420 ,,
,, of potassium	2·500 ,,
Fluorine (as fluoride of calcium)	trace
Phosphoric acid (as phosphate of lime)	trace
	20·579
Carbonic acid	15·66 cub. in.
Nitrogen	206·00 ,, ,,

(E.)

Cases illustrating the value of Vichy Waters.

Many cases are related by Dr. Petit, illustrating the effects produced by the method of treatment by the exhibition of Vichy waters. From these we will select three in which the advantages appeared most apparent.

M. D., aged 36, of a sanguine temperament and robust constitution, had always been of sober habits, and had led a regular life ; his grandfather was very gouty. Previous to 1835, this gentleman had experienced some transitory pains in the joints of the feet, but in the month of August of the same year he was suddenly seized with an extremely acute pain in the ball of the right great toe, accompanied with redness, heat, and swelling of the affected part, which lasted fifteen days. At the same period of the following year, August, 1836, M. D. experienced a similar attack in the ball of the left great toe, but more severe and longer in duration, lasting almost a month. These attacks came on without any appreciable cause. He went to Vichy on the 13th of August, 1837, and took the waters till the 9th of September, during which time he had a slight attack, which lasted but three days, and did not prevent his continuing the treatment ; he had no other attack during the year. In 1838, he returned to Vichy and was free from gout all the year. In 1839, he did not go to Vichy, but took alkaline drinks. Up to January, 1840, he had not experienced any fresh attack and had enjoyed good health.

M. A., aged 48 years, living at Saint-Pourçain (Allier), came to Vichy the 13th of August, 1837. At the age of 40 he experienced the first fit of gout. This attack was neither long nor very painful ; after this he each year experienced one or two attacks, longer in duration and some more severe than others. During the years 1834 and 1835, the pains became intolerable, and his urine deposited much red sand. In 1836, the pain of the gout and of stone became so intense, that he was unable to walk, or to ride on horseback, or drive in a carriage ; the least travelling caused painful suffering, and rendered the urine bloody. During his stay at Vichy, he drank daily before and between his meals thirty or thirty-five glasses of the water, and took a bath each day, in which he frequently voided a great number of small pieces of stone, which became reduced to sand when pressed between the fingers. He soon experienced well marked relief, and at the end of twenty days was able to attend to his affairs without suffering. On his return home, he drank the Vichy water and other alkaline liquids. In 1838 he was unable to get to Vichy, but he returned in 1839, when he experienced even more relief than on his first visit, and expelled many fragments of a calculus after the use of the bath. In 1840, he wrote to this effect : "Since my first visit to Vichy the gout has entirely disappeared, and far from experiencing any derangement of my health from its non-appearance, I have lost the acidity to which I was very subject. At present I am in a condition to walk three or four leagues a day without either pain or fatigue ; I have even travelled twelve leagues a day in a bad springless coach, and along a rugged road. This year I propose to go to Vichy, not on account of the gout, from which I am free, but to remove the remainder of the stone which still troubles me ; meanwhile I continue the use of the alkaline drinks and the regimen, and I hope to get rid of the stone as well as the gout."

This patient returned not only in 1840, but in 1841 and 1842, and afterwards at longer intervals up to 1849 ; he had two slight returns of gout in 1848, but these he attributed to some irregularity of diet.

M. M. B., of Saint-Pourçain, 65 years of age, and had been subject to gout for twenty-five years, came to Vichy for the first time in 1844. He was at that time troubled with gravel, and it seemed from the symptoms which he had experienced in 1814 that his first attack of nephritic colic then took place. This has frequently returned, sometimes extremely violent and accompanied with the expulsion of small calculi ; an attack in 1826 lasted sixteen days. Two of his maternal uncles had experienced gout, but the attacks had not been serious and had occurred at long intervals. For a long time M. M. B. had wished to try the Vichy waters, but his physician, not being an advocate for their use, had dissuaded him from so doing, and had sent him for six successive years to other watering-places, where he found no relief, but lost strength and the use of his limbs, so that at last he was obliged to resort to crutches. A few days after his return from these waters he had attacks of gout, which lasted a long time, and occurred at least three times in the year, leaving him not more than three months in a state of comparative freedom from suffering.

When he had determined to go to Vichy in 1844, most of the joints were more or less seriously injured from the repeated attacks of gout which he had experienced. He could with great difficulty bend the knees, especially the right one, whose movements were very incomplete and limited, but the articulations of the feet were entirely anchylosed, and he had no use of the ankle joint. The tendo-achilles on the right side was so much retracted, that on standing up the point of the foot only touched the ground. Supported by crutches, he was just able to drag his legs after him, rather than walk, and he was thus reduced almost to the state of a cripple. Having examined the condition of the joints, Dr. Petit acknowledged that he could afford but little hope of ever enabling him to walk ; however, the treatment was commenced, and after a month's sojourn at Vichy, some improvement had already taken place, the knees were able to be extended a little more, and some little movements were noticed in the joints of the feet. Between this time and his next visit to Vichy in 1845, he experienced no return of the disease, and was able to walk easily with the aid of his crutches. In 1846 he walked better still, and even without his crutches, which, however, he still used in order to prevent fatigue when he went any distance. In February 1848, he had a slight attack of gout in the hands, but not in the feet. Lastly, in 1849, the last time he came to Vichy, although he still used his crutches when he had to go any distance, and his joints had acquired but a slight degree more power of movement or of being extended, still his general health was very good, and he walked very quickly and with tolerable ease.

(F.)

Analyses exhibiting the influence of the Wiesbaden Water upon the Urinary Secretion (Braun).

A man about thirty years old and in good health, was put upon a regulated and meagre diet, taking equal and moderate exercise. On the fourth day the urine was collected and examined :—

The quantity in the 24 hours was 45 ozs. (by weight).

Urea	112·19 grs.
Uric acid	13·15 ,,
Chloride of sodium (common salt)	171·69 ,,

When an additional half pound of ordinary water was next day added to his diet, the results were—

Quantity of urine in the 24 hours	51 ozs. (by weight).
Urea	119·42 grs.
Uric acid	13·61 ,,
Chloride of sodium	173·51 ,,

Next day half a pound of Wiesbaden water was substituted for the ordinary water, and the following results :—

Quantity of urine in the 24 hours	66 ozs. (by weight).
Urea	221·73 grs.
Uric acid	20·74 ,,
Chloride of sodium	204·12 ,,

A second trial of the same experiment gave

Quantity of urine in the 24 hours	63 ozs. (by weight).
Urea	186·91 grs.
Uric acid	16·14 ,,
Chloride of sodium	221·31 ,,

It is stated that in other trials the augmentation of the urine varied from twelve to twenty ounces, and that the urea, uric acid, and common salt were also increased in the same proportion.

Effects of the Mineral Waters, when taken in larger but moderate doses.—The subject of the above experiment was again selected, and the same diet persevered with ; a pound of common water was added to his diet on the fourth day, and the quantity and composition of the urine was as follows :—

Quantity of urine in the 24 hours	61 ozs. (by weight).
Urea	166·91 grs.
Uric acid	14·04 ,,
Chloride of sodium	201·71 ,,

The next day, a pound of the mineral water was taken in the course of from half to three-quarters of an hour, and the

Quantity of urine in the 24 hours	76 ozs. (by weight).
Urea	246·354 grs.
Uric acid	23·712 ,,
Chloride of sodium	249·31 ,,

In three other trials, the urine varied in quantity from seventy to eighty-five ounces, the urea from 247 to 265 grains, the uric acid from nineteen to twenty-eight grains, and the chloride of sodium from 263 to 320 grains. Only one experiment is given by Dr. Braun of the effect on the urine produced by the waters, when taken in very large doses; when

Quantity of urine in the 24 hours . .	48 ozs. (by weight).
Urea	114·12 grs.
Uric acid	12·91 ,,
Chloride of sodium . . .	226·11 ,,

In another observation the quantities only of the urine were determined, and found to be fifty-three and fifty-one ounces respectively.

The physiological effects produced by the use of these waters, in the form of either the tepid or warm bath, appear to be the same as those induced by a mixture of common and sea water, and I believe that no real difference could be distinguished between the effect of one and the other.

Effects of tepid baths on the urine.—Dr. Braun has also given in his work the effect of these baths on the urine, choosing for the observations a man, previously prepared by a regulated diet, and moderate exercise. On the three days of this diet, the examination of the urine gave the following results:—

Quantity of urine passed in the 24 hours	48 to 54 ozs. (by weight).
Urea	110 to 138 grs.
Uric acid	11 to 13 ,,
Chloride of sodium . .	160 to 176 ,,

The next day, when taking a bath of ordinary water of half an hour's duration, at the temperature of about 90° Fahr., the numbers were,—

Quantity of urine in the 24 hours	39 ozs. (by weight).
Urea	141·32 grs.
Uric acid	14·81 ,,
Chloride of sodium	174·11 ,,

On the following day, a bath of the mineral water was taken at about the same temperature and of the same duration, and the effects on the urine are seen to be,

Quantity of urine in the 24 hours	56 ozs. (by weight).
Urea	181·90 grs.
Uric acid	13·01 ,,
Chloride of sodium	169·44 ,,

Repetitions of the experiment gave

Quantity of urine in the 24 hours	58 ozs. (by weight).
Urea	121·31 grs.
Uric acid	16·02 ,,
Chloride of sodium	234·12 ,,

When the experiments were multiplied, somewhat variable results were obtained, but there was always produced by the use of the mineral an augmentation of the quantity of urine to the extent of some ounces, and at the same time a notable difference in the amount of the chloride of sodium.

Effects of hot baths on the urine.—When the temperature of the bath was increased to 97° Fahr., the results became modified, and were as follows :—

A subject placed in circumstances similar to those above indicated, passed during three days from forty-two to forty-five ounces of urine. On the fourth day took a bath of ordinary water at the temperature of 97° Fahr. ; much perspiration took place during and after the bath, and the urinary secretion was

Quantity in the 24 hours	39·5 ozs. (by weight).
Urea	167·11 grs.
Uric acid	16·35 ,,
Chloride of sodium	191·34 ,,

The same regimen being continued, on the sixth day a bath of mineral water at the temperature of 97° Fahr. was taken, which produced much perspiration.

Urine in the 24 hours	37 ozs. (by weight).
Urea	263·79 grs.
Uric acid	11·41 ,,
Chloride of sodium	201·01 ,,

Further experiments exhibited a diminution of from four to ten ounces in the quantity of urine when a mineral hot bath was used, and from one to five ounces after the use of the ordinary hot bath.

From experiments made on the perspiration of patients submitted to the thermal treatment at Wiesbaden, it would appear that neither the internal nor external use of the waters have any effect in increasing the amount of common salt contained in the perspiration, and therefore this principle does not appear to be eliminated by the skin.

Analyses exhibiting the influence of Wiesbaden Waters upon the Urinary Secretion (Neubauer).

The results of Neubauer, referred to at page 489, differing completely from those given above, will be seen in the following Table, in which the amounts of uric acid contained in the 24 hours' urine are indicated.

	Minimum.	Medium.	Maximum.
FIRST INDIVIDUAL.			
α Living as usual (5 days) .	0·31 grs.	4·32 grs.	9·41 grs.
β Taking a bath of warm water each day for half-an-hour, at 82° Fahr. (5 days)	5·56 ,,	6·79 ,,	8·18 ,,
γ Bath as before, in addition to which about 17 or 18 fl. ozs. of Wiesbaden water (Kockbrunnen)(7 days)	2·01 ,,	4·17 ,,	7·72 ,,
SECOND INDIVIDUAL.			
1. Living as usual (8 days)	5·09 ,,	7·56 ,,	10·34 ,,
2. Living as β, first individual, (5 days) . .	7·10 ,,	9·26 ,,	12·50 ,,
3. Living as γ, first individual, (8 days) . .	4·68 ,,	7·87 ,,	10·34 ,,

---

* Extracted from Thudichum's Work on Urine.

(G.)

Cases of Acute Rheumatism, in which an Examination of presence of

MALES.

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
G. J.	30	Cabman.	Regular.	None to rheumatism. or gout.	Good till he had rheumatism	Third attack. First about eight years since.
J. J.	31	Linen-draper's man.	Regular.	—	Pretty good.	Second attack. First three years before.
W. K.	20	Carpenter.	Regular. Temperate.	None to gout or rheumatism.	Good.	First attack.
T. W.	33	Tailor.	Usually not intemperate Lives well.	Mother subject to rheumatism; sisters and brothers not affected.	Good.	First attack.
H. W.	28	Costermonger.	Not given.	None stated.	Good.	First attack.
J. S.	57	Carpenter.	Lives well; not intemperate; drinks beer, & a little gin.	Grandfather on father's side affected with rheumatism.	Good.	First attack.
J. G.	26	Labourer, lately a potman in a public-house	Not stated.	None to gout or rheumatism.	Not good for the last few years; scrofulous knee, &c.	First attack.
J. A.	34	Cabman.	Not stated.	Not stated.	Good till he had rheumatism	Second attack. First attack eight years since; many joints affected.

the Blood was performed for the purpose of ascertaining the Uric Acid.

MALES.

Cause of.	Symptoms during Attack.	State of Blood.
Cold.	Commenced in knees, afterwards shoulder, elbow. Skin perspires freely. Pulse 72. Tongue white, furred; thirst moderate; no appetite. Slight pericarditis: old heart affection.	Clot firm, slightly buffed; serum alkaline; sp. gr. 1027·04 at 60° F. No trace of uric acid.
None assigned.	Commenced in feet, then in knees, wrists, and ankles. Pulse 112, full, hard. Tongue furred; no appetite; thirst. No cardiac affection.	Clot firm; a little cupped; serum alkaline; sp. gr. 1026·8 at 69° F. No trace of uric acid.
None, except some draught.	Commenced in knees; then wrists, ankles, and feet. Pulse 84, hard. Tongue furred; skin hot. No cardiac affection.	Clot normal; serum alkaline; sp. gr. 1028·0 at 63° F. No uric acid.
—	Commenced in right shoulder, then left; afterwards right knee. Joints not very acutely affected. Pulse 88, hard. Tongue not furred; appetite moderate. No heart affection.	Clot buffed; not cupped; serum alkaline; sp. gr. 1028·4 at 55° F. No uric acid.
Cold.	Commenced in hip, then left ankle, knees; afterwards wrists and hands. Pulse 96, hard. Tongue furred; thirst; no appetite. No pitting on pressure. Free perspiration. No heart affection.	Clot firm; serum alkaline; sp. gr. 1028·8 at 48° F. No uric acid.
Cold.	Commenced in left knee and thigh, then right foot and instep; afterwards right elbow. Pitting on outer side of foot. Tongue furred. Pulse 78. No heart affection.	Clot normal; serum alkaline; sp. gr. 1029·2 at 51° F. No uric acid. *Blister fluid.* No uric acid.
—	Commenced in right thigh, then knee, back, shoulders, left elbow, wrist, and hand. No pitting of dorsum of hand. Pulse 108, rather hard. Tongue furred; perspiration; thirst. No heart affection.	Clot slightly buffed and cupped; serum alkaline; sp. gr. 1030·4 at 47° F. No uric acid. Second: Clot very slight buffed; serum alkaline; sp. gr. 1030·4 at 42° F. No uric acid.
—	Commenced in right hand, then feet, knees, shoulders, and hips, and ankles, and left hand; also fingers. Pulse 108, hard. Tongue furred; thirst; no appetite. No cardiac affection.	Clot little buffed, firm; serum alkaline; sp. gr. 1028·0 at 52° F. No trace of uric acid.

Name.	Age	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
C. G.	30	Carpenter.	Regular.	None to gout or rheumatism	Good.	First attack.
			FEMALES.			
H. M.	27	Servant.	Regular.	Father had rheumatism (not acute).	About a year since had slight hemiplegia, and six years ago paralysis of right side of face.	First attack.
A. M.	32	Dressmaker.	Regular.	None to gout or rheumatism.	Pretty good until lately.	Second attack. First attack commenced about four months ago. Second attack had been neglected for many weeks.
E. A.	40	Married.	Regular.	None to rheumatism or gout.	Good.	Second attack. First attack 14 years since, all joints affected.
R. K.	21	Servant.	Regular.	Not stated.	Good.	Second attack. First attack nine years since.
S. S.	17	Servant.	Regular.	None to gout or rheumatism.	Good.	First attack.
S. S.	26	Married.	Regular.	Mother slightly rheumatic; one brother has had 3 attacks of rheumatism	Good until lately.	First attack.

Cause of.	Symptoms during Attack.	State of Blood.
—	Commenced in different joints of lower, then upper; both wrists much swollen. No heart affection. Pulse 100, hard. Tongue furred; perspires much; thirst.	Clot buffed, cupped; serum alkaline; sp. gr. 1028·0 at 72° F. No trace of uric acid.
	FEMALES.	
Cold.	Commenced with tonsillitis; after some days right foot and ankles, then knees, then wrists and shoulders. Slight pericarditis. No pitting on pressure. Pulse 120. Tongue furred; thirst; no appetite; perspires freely.	Clot firm, slightly buffed; much cupped; serum alkaline; sp. gr. 1026·7 at 63° F. No trace of uric acid.
Cold.	First: commenced about four months since, as an attack of acute rheumatism, with nearly all joints affected, and some heart affection. (Not in hospital.) Second: all joints affected as before; after eight weeks came into hospital, with swelling of wrists and dorsum of hands, and some small joints of fingers, knees tender, and left elbow, shoulder somewhat painful. Pulse 84; not very febrile.	Clot not buffed or cupped; serum alkaline; sp. gr. 1030·0 at 60° F. No trace of uric acid. *Serum of blister* clear, pale yellow; sp. gr. 1026·0 at 60° F. No uric acid.
Cold—wet.	Commenced in shoulders, then ankles; afterwards elbows, wrists, knees. No heart affection. Pulse 105, hard. Tongue furred.	Blood serum by thread experiment. No trace of uric acid.
Not given.	Commenced in left foot and ankle, then right hand, wrist, and fingers; afterwards knees. Pulse 100, hard. Tongue furred; perspiration; thirst. No marked heart affection.	Clot firm, slightly buffed, and cupped; serum alkaline; sp. gr. 1028·8 at 60° F. No uric acid.
Cold.	Commenced in knees, then almost all joints of body; left wrist, right knee and ankle especially so. Pulse 130, hard. Tongue furred; much perspiration. Endocarditis; pericarditis.	Clot buffed, slightly cupped; serum alkaline, sp. gr. 1024·08 at 40° F. No uric acid.
Not known; perhaps cold from washing.	Commenced in knees, then ankles and feet; afterwards hands, elbows, and shoulders. No heart affection. Pitting on pressure of dorsum of hand. Pulse 108, hard. Tongue furred; moderate perspiration, thirst, &c.	Clot firm, slightly cupped and buffed; serum alkaline; sp. gr. 1027·6 at 48° F. No trace of uric acid.

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
C. L.	25	Married; a laundress.	Regular.	None to gout or rheumatism.	Not very good.	First attack.
M. A. P.	25	Laundress.	Regular.	None to rheumatism or gout; or questionable to rheumatism from father.	Good.	First attack.
A. P.	54	Cook; widow.	Regular.	None to rheumatism or gout.	Good.	First attack. Perhaps one thirty years before, but doubtful. Said to arise from mercurial ointment on hands.
M. A. R.	17	Servant.	Regular.	None to rheumatism or gout.	Not very good. Weak and hysterical.	First attack.
A. C.	30	Servant.	Regular.	None to rheumatism or gout.	Good.	First attack.
L. E.	31	Married. Household work.	Regular.	To rheumatism on father and mother's side.	Pretty good. Subject at one time to fainting (hysteria ?)	Third attack.
E. S.	27	Married.	Regular.	To rheumatism from mother. Two sisters affected.	For last few years has been in a weak state of health.	First attack.

Cause of.	Symptoms during Attack.	State of Blood.
Cold and damp.	Commenced in ankles, hips, and knees, then in joints of upper extremities. No heart affection. Pulse 116, hard. Tongue furred; thirst; no appetite.	Clot firm, cupped, buffed; serum alkaline; sp. gr. 1031·6 at 69° F. No trace of uric acid.
Cold.	Commenced in shoulders, then loins, feet, and hips. Since admission, ankles, knees, elbows, wrists acutely inflamed. Pulse 130, not full. Pain increased at night; much acid perspiration; tongue furred; no appetite. Pericarditis with effusion.	Clot firm, buffed, rather cupped; serum alkaline; sp. gr. 1029·5 at 60° F. No trace of uric acid by thread experiment.
—	Commenced in hip, then in knees, left wrist, and dorsum of hand. Little perspiration. Pitting of hand and legs on pressure. Albuminuria when admitted. Peri- and endo-carditis. Query if very recent.	Clot firm, buffed, rather cupped; serum alkaline; sp. gr. 1024·8 at 60° F. No trace of uric acid.
Cold.	Commenced in both ankles, then both knees, hips, shoulders, elbows, wrists, and hands. No pitting on pressure. Pulse 120, hard. Tongue furred, white; much thirst; no appetite. Distinct endocarditis.	Clot firm, normal; serum alkaline; sp. gr. 1026·32 at 65° F. No trace of uric acid.
Cold in the feet.	Commenced in knees; heart early affected; then hips and shoulders. Tongue much furred; much thirst; no appetite. Pulse 110 when admitted. Aortic regurgitant in character. Perspiration moderate. Endo- and peri-carditis very severe.	Clot firm, somewhat buffed; serum alkaline; sp. gr. 1026·65 at 60° F. No trace of uric acid.
None assigned.	Affection of knees, ankles, wrists, shoulders. Moderate perspiration. Pulse 96, moderate, full. Tongue brown, furred; thirst; no appetite. Slight endocarditis.	Clot firm, slightly buffed and cupped; serum alkaline; sp. gr. 1028·5 at 60° F. No trace of uric acid.
Cold and damp.	Commenced in knee, then ankles, hips, shoulders, elbows, and dorsum of hands. No pitting. Pulse 105. Tongue furred; thirst; no appetite; perspiration moderate. No heart affection.	Clot firm, buffed, cupped; serum alkaline; sp. gr. 1025·0 at 60° F. No trace of uric acid.

Name.	Age.	Occupation.	Habits of life.	Hereditary Predisposition	General state of Health.	No. of attacks.
E. W.	43	Married. Takes in washing.	Regular.	To rheumatism from father. One sister affected.	Good.	Second attack. First at sixteen years of age.
E. E.	43	Widow.	Regular.	To gout from father. Two brothers had gout, and one acute rheumatism.	Very weakly.	First attack.
E. F.	18	Lives at home.	Regular.	To rheumatism from mother.	Not strong.	Fifth attack. First at nine years of age.
J. S.	38	Married.	Not stated. Lives poorly, insufficient food.	No tendency to gout. Father has rheumatism.	Good.	First attack.
A. R.	25	Servant.	Regular.	None stated.	Good, except rheumatism.	Second attack. First attack nine years since ; all joints affected.
E. W.	34	Married.	Regular.	Not stated.	Good until lately ; since last confinement has felt very weak.	First attack.
M. A. S.	22	Servant.	Lived pretty well ; worked hard in general.	None to gout or rheumatism.	Good.	First attack.
M. B.	16	Servant.	Regular.	None to gout or rheumatism.	Good.	First attack.

Cause of.	Symptoms during Attack.	State of Blood.
None assigned.	Commenced in feet, then knees, hips, one wrist, shoulder, muscles of one side of neck and head. Pulse 96, hard. Tongue white, furred. Pitting of wrist and hand on pressure. Endocarditis (slight), old probably.	Clot buffed, cupped; serum alkaline; sp. gr. 1029·0 at 50° F, No trace of uric acid.
None discoverable.	Commenced in left hip, then in ankle and knee; after wrists and dorsum of hands. Pitting on pressure. Pulse 108, full and hard. Tongue furred; thirst; no appetite. No heart affection.	Clot firm, large, buffed, slightly cupped; serum alkaline; sp. gr. 1026·4 at 55° F. No trace of uric acid.
Cold.	Commenced in ankles, afterwards in knees, shoulders, elbows, and wrists, and joints of hands. Pulse 135, hard. Tongue furred; perspiration moderate; skin hot. No heart affection.	Clot buffed, cupped; serum alkaline; sp. gr. 1028·0 at 63° F. No trace of uric acid.
Damp residence; insufficient clothing. Nursing child when admitted.	Commenced in palmar surface of limbs, great toe much affected; also dorsum of foot; then hip, right arm, wrist, hand, &c. No heart affection. Pulse 100, hard. Tongue furred; thirst.	Clot firm; serum alkaline; sp. gr. 1028·8 at 52° F. No trace of uric acid.
—	Commenced with erythema nodosum, then joint affection; both hands, elbows, knees, and feet. No heart affection. Pulse 108. Tongue furred; thirst, &c.	Clot slightly buffed; serum alkaline; sp. gr. 1030·8 at 57° F. No trace of uric acid.
Nursing at the time. No very evident exposure.	Commenced in joints of lower extremities; then shoulders, elbows, wrists. No cardiac affection. Pulse 92. Tongue furred; thirst.	Clot buffed, much cupped; serum alkaline; sp. gr. 1030·0 at 50° F. No uric acid.
None known.	Commenced in right wrist, then right shoulder. Slight endocarditis. Pulse 116; thirst; perspiration.	Clot buffed, contracted and cupped; serum alkaline; sp. gr. 1030,4 at 53° F. No uric acid.
Not known. Lived in London a month.	Commenced in left wrist, then right; then right foot. Pulse 112, rather hard. Tongue furred; no marked perspiration. Some pitting over dorsum of foot. No cardiac affection.	Clot buffed, moderately cupped; serum alkaline; sp. gr. 1028·4 at 68° F. No trace of uric acid.

Cases of which the minute details were less known.

Name.	Sex.	Account of Patient.	State of Blood.
N. N.	M.	Acute rheumatism, diagnosed by a physician.	Clot buffed ; serum alkaline ; sp. gr. 1030·0 at 56° F. Uric acid thread experiments gave no trace of uric acid.
M. C.	M.	Patient suffering from sub-acute rheumatism. Commenced about a year and quarter since in wrist and ankle, then other joints. Great toe never affected. No gout in family.	*Blister serum* alkaline ; sp. gr. 1024·0 at 66° F. No trace of uric acid by uric acid thread experiments.
A. K.	M.	Acute rheumatism, diagnosed by a physician.	Clot firm, buffed, and somewhat cupped ; serum alkaline ; sp. gr. 1028·0 at 60° F. Uric acid thread experiments gave no trace of uric acid.
A. B.	—	Patient with acute rheumatism and pericarditis.	*Blister fluid ;* serum alkaline ; sp. gr. 1026·64 at 60° F. No trace of uric acid by thread experiment.
G. C.	M.	Sub-acute rheumatism of several years' standing. Great toe never affected ; weather and not diet produces exacerbations.	*Blister serum ;* serum alkaline ; sp. gr. 1023·0 at 60° F. No uric acid by uric acid thread experiment.

INDEX.

A.

PAGE
Abscesses, gouty . . . 87
— treatment of . . 460
Accidents, a cause of gout . 302
Ægineta, views of . . 16
Aetius, views on gout . . 15
Age, influence on gout . . 255
Air, fresh, in gout . . . 470
Aix-la-Chapelle, analysis of its waters . . 577
—— value of its waters in gout . 490
Albumen in urine in acute gout 166
— — in chronic gout 176
Alcoholic liquors, influence on gout . . . 260
Ale, predisposing to gout . . 266
Alkalies in treatment of gout 424
Ammonia, phosphate of, in gout 432
Analysis of urine, method of 563
Anchylosis from gout . . 73
Animal food in gout . . 273
Anodynes and narcotics . . 374
Anxiety a cause of gout . 276
Arabian physicians, their views on gout . . . 18
Areteus, views of . . 9
Ash-leaves in gout . . . 449
Atonic gout . . . 449
Author's views of the curability of gout . . . 362
Aurelianus, views of . . 13

B.

Bath waters 493
Blisters 380
Blister fluid in gout . . 135
PAGE
Blood-letting . . . 376
Blood, condition of in gout . 100
— discovery of uric acid in . . 107
— — urea in . 138
— oxalic acid in . . 139
— in lead-poisoning . 292
— excess of uric acid in 118, 341
— in acute rheumatism . 588
Bones, analysis of, in chronic gout 203
Brain, gouty affection of . 522
Brodie, Sir Benjamin, dissection of a gouty subject . 189
Budd, Dr. W., examination of gouty cartilage . . 203
Bursæ Mucosæ affected in gout 82
Buxton waters in gout . . 492
— — analysis of . 578

C.

Carlsbad waters . . 491
— analysis of . . 577
Cartilage, alteration of . 228
Causes of gout . . . 249
— predisposing . . 250
— exciting . . . 297
Celsus, views of . . . 7
Cælius Aurelianus, views of . 13
Chalk-stones, occur only in gout . . 68
—— composition of 70
—— microscopic appearance of 70
—— on the ear only 75, 205

PAGE
Chalk-stones, frequency of occurrence . 74
—— treatment of . 455
Cheltenham waters . . . 492
Chelius, on effect of colchicum on urine . . 395
Christison, Dr., on lead-poisoning . . 284
—— on effect of colchicum on urine . . 394
Chronic gout . . . 65
—— treatment of . 417
Cider, a cause of gout . . 267
Climate, influence of . . 279
Colchicum 386
— analysis of . . 388
— physiological effects of . . . 389
— effects on the urine 401 575
— therapeutic action of . . . 403
— rules for its administration . . 408
— different preparation of . . 410
Colchicia 388
— effects of . . 415
Cold, effects of . . . 300
Concretions, gouty . . . 68
Costé, M., views of gout . . 21
Cramp in gout. . . . 518
Cruvelhier's dissection of a gouty subject . 191
Cullen's division of gout . 27
— view of treatment 259

D.

Davy, Dr., method of determining urea . 564
Demetrius Pepagomenos, views of . . 17
Desquamation of cuticle 39, 351
Diagnosis of gout . . . 527
Diaphoretics . . . 373
Diet in acute gout . . . 365
— chronic gout . . 462
Digestive organs, gout of . 508

PAGE
Differential diagnosis of gout, &c. . . . 544
Digitorum nodi . . . 537
Diseases in connection with gout . . 547
Diuretics 373
Dufresne, M., dissection of a gouty subject . 193
Dyspepsia, a cause of gout 274, 299

E.

Ear, gout of the . . . 514
Edema in gout . 39, 58, 351
Emetics 372
Ems waters 492
Exercise, vulue of . 273, 468

F.

Fermented liquors, a cause of gout . . . 260
Ferruginous preparations . 453
Fraxinus Excelsior in gout . 441

G.

Gairdner, Dr., view of gouty fit . . 334
—— — on blood-letting 377
Galen, views of . . . 8
Gastein 492
Gout, its antiquity . . 1
— ancient knowledge of . 4
— synonyms of . . . 5
— origin of word . . 5
— acute 31
— special affection of great toe in . 37
— — exceptional cases of . . . 45
— characters of inflammation in . . 38
— simulating acute rheumatism . . . 51
— recurrence of . . 63
— chronic . . . 65
— illustrative cases of . 80
— misplaced . . . 68
— irregular forms of . 496

PAGE

Gout, retrocedent . . 68, 501
— blood in . . . 100
— blister fluid in . . 135
— perspiration . . 141
— urine in . 154, 571
— morbid anatomy of . 185
— causes of . . . 249
— nature of . . . 304
— treatment of acute . 364
— — of chronic . 417
— — retrocedent. 507
— — irregular . 524
— diagnosis of . 527, 544
— prognosis of . . . 551
Guaiacum . . . 421, 545

H.

Heart affected by gout 505, 510
Heberden, on the sequelæ of gout . . 55
—— on Portland powder . . . 449
Hellebore, white . . 413
Hereditary predisposition . 250
Hermodactylus . . . 386
Hippocrates, views of . . 6
Holland, Sir Henry, views of gout 336
Homburgh waters . . 492

I.

Indigestion, a cause of gout 274, 299
Iron preparations . . 453
Irregular gout . . . 496
—— affecting digestive organs 508
—— — heart. . . 510
—— — respiratory organs . . 511
—— — urinary organs 512
—— — eye and ear . 514
—— — skin . . 516
—— — nervous and muscular systems . . 517
treatment of . 524

PAGE

J.

Johnson, Dr. George, on microscopic appearances of kidneys in gout . . 243
Jones, Dr. H. Bence, on the acidity of urine . 154
—— — on wines . 269

K.

Kidneys in gout . . 236
— microscopic appearances of . . 243
Kissingen waters . . . 492

L.

Lead, influence of, in gout . 281
— poisoning, condition of blood in . . . 292
Leeches in acute gouty inflammation . . . 379
Liebig's method of estimating urea 569
Lithia salts in gout . . 437
Lucian's Tragapodagra, extracts from . . . 22

M.

Mania, gouty . . . 522
Marienbad waters . . 492
Mercurials 373
Mineral waters in gout . . 475
—— of Aix-la-Chapelle 490
—— of Buxton . . 493
—— of Carlsbad . 491
—— of Teplitz . . 493
—— of Vichy . . 477
—— of Wiesbaden . 486
—— of Wildbad . . 493
Moore, Mr., on Gouty concretions . . 87
—— — on treatment of ditto . 460
Morbid anatomy of gout . 485
Mulder on wines . . 269
Muscular system, gout of the 517

PAGE

N.

NATURE of gout . . . 304
— Cullen's view of . 319
— Murray Forbes' view of 326
— Author's view of . 338
Nervous system, gout of the 517
Neuralgia, gouty . . 520

O.

OXALIC acid in gouty blood . 139
—— in gouty perspiration . . 144

P.

PATHOLOGY of gout . . 304
Perspiration in gout . . 141
Petit, Dr., cases of gout treated at Vichy . . 579
Porter, predisposing to gout 266
Portland powder . . 448
Potash salts 433
Predisposing causes . . 250
Prognosis of gout . . . 551
Prophylactic treatment of gout 473
Purgatives . . . 368
Pyrmont waters. . . . 494

Q.

QUININE in gout . . 450
— influences of, on uric acid . . . 451

R.

REGIMEN in gout . 367, 462
Respiratory organs, gout of . 511
Retrocedent gout . . . 501
— — treatment of 507
Rheumatic gout . . . 526
— arthritis . . 532
Rheumatism; differential diagnosis from gout 529
—— condition of blood in . . . 588
—— capsular . . 531

PAGE

Rheumatoid arthritis . . 532
—— description of . 534
—— treatment of . 543
—— diagnosis of, from gout and rheumatism . . 544

S.

SALINES . . . 371, 424
Schwallbach waters . . 494
Scudamore, Sir C., table exhibiting the influence of hereditary predisposition . 250
—— — period of first attack . . 256
—— — seat of inflammation in first attack . . 35
Season, influence of . . 280
Sex, influence of . . 253
Skin, gout of the . . . 516
Soden waters . . . 492
Spa waters 494
Spinal cord, gout of . . 523
Spirits, distilled, their influence in inducing gout . 261
Stomach, gout of . 501, 508
Stomachics in gout . . 446
Sydenham's description of a fit of gout . 62
—— — of chronic gout 97

T.

TEMPERAMENT, influence of . 258
Teplitz waters . . . 493
— analysis of . . . 578
Todd, Dr., on gouty kidney . 236
— on blisters in gout 381
Tophaceous deposits . . 68
Trallianus, Alexander, views of 14
Treatment of gout . . 359
— of acute gout . . 364
— of chronic gout . 417
— of chalk-stones . 455
— of gouty abscesses 460
— prophylactic . . 473
— of irregular gout . 524

PAGE

Treatment of retrocedent gout 507
— of rheumatic gout 543
— of rheumatoid arthritis . . 543
Tunbridge Wells, waters of 494

U.

Urate of soda, exists in gouty blood . 108
— — always deposited in gouty inflammation 342
— — the essential constituents of chalk-stones 70
Urea in gouty blood . . 138
— methods of determining in urine . . . 564
Uric acid, in blood . . 107
— simple method of detecting in blood 110
— changes occurring in, during decomposition of blood. 114
— its constant presence in gouty blood . 117, 341
— in blister serum . 135
— in blood in lead-poisoning . . 292
— characters of . . 305
— composition of . 306
— method of determining in urine. 563
— not contained in blood in rheumatism . . 588

Urinary organs, gout of . 512
Urine, healthy characters of 146
— in acute gout . . 158
— in chronic gout . 166
— in intervals of fits . 178
— frequent presence of albumen in . . 176
— microscopic character of, in chronic gout 182
— in lead-poisoning . 287
— analysis of, for uric acid . . . 563
— analysis of, for urea . 564

V.

Veratria 416
Veratrum album . . 413
Vichy waters 477
—— analysis of . 575
—— cases treated by 579

W.

Waters, mineral . . 475
Watson, Dr., remarks on colchicum in gout . 407
Wells, Mr. Spencer, dissection of a gouty toe 225
Wiesbaden waters . . 486
—— analysis of . 576
—— effects of, on the urine . 582
Wildbad waters . . . 493
—— analysis of . 578
Wines, effect of, in gout . 265
Wollaston, Dr., analysis of chalk-stones . 71

THE END.

BRADBURY AND EVANS, PRINTERS, WHITEFRIARS.

By the same Author.

THE ESSENTIALS OF MATERIA MEDICA, Therapeutics, and the Pharmacopœias. For the use of Students and Practitioners. By ALFRED BARING GARROD, M.D., Professor of Materia Medica and Therapeutics, in University College, London. Fcap. 8vo. 6*s.* 6*d.* cloth.

The present work is intended to serve the student as a text-book of Materia Medica, and while it is hoped that it omits nothing essential to the study of the science, it excludes those details often embarrassing to the student, and seldom necessary to the practitioner. It has been the author's object, while limiting the size of the book, to include all points connected with the officinal preparation of medicines, and so much information on the therapeutic action of drugs as would serve as a sufficient guide in actual practice. All controversial points have been avoided, as unsuited to the design of the work, and the information confined to the facts really ascertained as to the action of each drug, and the purposes for which it has been advantageously employed.

SCIENTIFIC WORKS.

DR. WALSHE ON DISEASES OF THE LUNGS, including the Principles of Physical Diagnosis. Third Edition, revised and greatly enlarged. 1 vol., small 8vo. (*Preparing.*)

DR. WALSHE ON DISEASES OF THE HEART and Great Vessels, including the Principles of Physical Diagnosis. Third Edit., revised and greatly enlarged. 1 vol., small 8vo. (*Preparing.*)

GLOSSARY OF SCIENTIFIC TERMS. For General Use. 12mo. *A cheap Volume.*

QUAIN'S ANATOMY. Sixth Edition. Edited by Dr. SHARPEY and Mr. ELLIS, Professors of Anatomy and Physiology in University College, London. Illustrated by upwards of 400 Engravings on Wood. 3 vols. small 8vo., £1 11*s.* 6*d.*

ELLIS'S DEMONSTRATIONS OF ANATOMY. A Guide to the Knowledge of the Human Body by Dissection. Fourth Edition. Small 8vo., 12*s.* 6*d.*

KIRKES'S HANDBOOK OF PHYSIOLOGY. Illustrations on Steel and Wood. Third Edition. Small 8vo., 12*s.* 6*d.*

ERICHSEN'S SCIENCE AND ART OF SURGERY. Second Edition, enlarged and carefully revised. Illustrated by 400 Engravings on Wood. 1 vol. 8vo., £1 5*s.*

LONDON: WALTON AND MABERLY.

SCIENTIFIC WORKS.

MR. QUAIN ON DISEASES OF THE RECTUM.

Second Edition, with plates. 1 vol. 7*s.* 6*d.*

DR. BALLARD ON PAIN AFTER FOOD.

1 vol. 4*s.* 6*d.*

GREGORY'S HANDBOOK OF CHEMISTRY.

Fourth Edition, revised and enlarged. Complete in 1 vol., small 8vo., 18*s.* cloth.

⁂ Sold also in 2 vols. (*separately*).

INORGANIC CHEMISTRY, 6*s.* 6*d.* ORGANIC CHEMISTRY, 12*s.*

LIEBIG'S FAMILIAR LETTERS ON CHEMISTRY

in its Relations to Physiology, Dietetics, Agriculture, Commerce, and Political Economy. Fourth Edition, revised and much enlarged. Small 8vo., 7*s.* 6*d.* cloth.

LARDNER'S ANIMAL PHYSICS; OR, THE BODY

and its Functions Familiarly Explained. Illustrated by 520 Engravings. 1 vol., small 8vo., 12*s.* 6*d.* cloth.

CONTENTS:

General View of the Animal Organisation—Bones and Ligaments—Muscles—Structure of the Lower Animals—Nervous System—Circulation—Lymphatics—Respiration—Digestion—Assimilation—Secretion—the Skin—Animal Heat—Senses—Touch—Smell—Taste—Vision—Hearing—Voice—Development—Maturity—Decline—Death.

QUAIN AND WILSON'S ANATOMICAL PLATES.

201 Plates, Royal Folio. 2 vols. half-bound morocco, 5*l.* 5*s.* plain, or 8*l.* 8*s.* coloured.

⁂ *Or in 5 Divisions, cloth (sold separately).*

		PLAIN.			COLOURED.		
		£	*s.*	*d.*	£	*s.*	*d.*
MUSCLES. 51 Plates	Cloth	1	5	0	2	4	0
VESSELS. 50 Plates	,,	1	5	0	2	0	0
NERVES. 38 Plates	,,	1	1	0	1	14	0
VISCERA. 32 Plates	,,	0	17	0	1	10	0
BONES AND LIGAMENTS. 30 Plates	,,	0	17	0	1	0	0

LONDON: WALTON AND MABERLY,
UPPER GOWER STREET, AND IVY LANE, PATERNOSTER ROW.

WALTON AND MABERLY'S

CATALOGUE OF EDUCATIONAL WORKS, AND WORKS IN SCIENCE AND GENERAL LITERATURE.

ENGLISH.

Dr. R. G. Latham. The English Language.
Fourth Edition. 2 vols. 8vo. £1 8s. cloth.

Latham's Elementary English Grammar, for the Use of Schools. Eighteenth thousand. Small 8vo. 4s. 6d. cloth.

Latham's Hand-book of the English Language, for the Use of Students of the Universities and higher Classes of Schools. Third Edition. Small 8vo. 7s. 6d. cloth.

Latham's Logic in its Application to Language.
12mo. 6s. cloth.

Latham's School Grammar of the English Language, adapted for general use. By Dr. R. G. LATHAM and an Experienced Teacher. Fcap. 8vo.

Latham's History and Etymology of the English Language, for the Use of Classical Schools. Second Edition, revised. Fcap. 8vo. 1s. 6d. cl.

Mason's English Grammar, including the Principles of Grammatical Analysis. 12mo. 3s. 6d. cloth.

Mason's Cowper's Task Book I. (the Sofa), with Notes on the Analysis and Parsing. Crown 8vo. 1s. 6d. cloth.

Abbott's First English Reader.
Third Edition. 12mo., with Illustrations. 1s. cloth, limp.

Abbott's Second English Reader.
Third Edition. 12mo. 1s. 6d. cloth, limp.

GREEK.

Greenwood's Greek Grammar, including Accidence, Irregular Verbs, and Principles of Derivation and Composition; adapted to the System of Crude Forms. Small 8vo. 5s. 6d. cloth.

Kühner's New Greek Delectus; being Sentences for Translation from Greek into English, and English into Greek; arranged in a systematic Progression. Translated and Edited by the late DR. ALEXANDER ALLEN. Fourth Edition, revised. 12mo. 4s. cloth.

Gillespie's Greek Testament Roots, in a Selection of Texts, giving the power of Reading the whole Greek Testament without difficulty. With Grammatical Notes, and a Parsing Lexicon associating the Greek Primitives with English Derivatives. Post 8vo. 7s. 6d. cloth.

Robson's Constructive Exercises for Teaching the Elements of the Greek Language, on a system of Analysis and Synthesis, with Greek Reading Lessons and copious Vocabularies. 12mo., pp. 408. 7s. 6d. cloth.

Robson's First Greek Book. Exercises and Reading Lessons with Copious Vocabularies. Being the First Part of the "Constructive Greek Exercises." 12mo. 3s. 6d. cloth.

The London Greek Grammar. Designed to exhibit, in small Compass, the Elements of the Greek Language. Sixth Edition. 12mo. 1s. 6d. cloth.

Hardy and Adams's Anabasis of Xenophon. Expressly for Schools. With Notes, Index of Names, and a Map. 12mo. 4s. 6d. cloth.

Smith's Plato. The Apology of Socrates, the Crito, and part of the Phaedo; with Notes in English from Stallbaum, Schleiermacher's Introductions, and his Essay on the Worth of Socrates as a Philosopher. Edited by Dr. Wm. Smith, Editor of the Dictionary of Greek and Roman Antiquities, &c. Third Edition. 12mo. 5s. cloth.

LATIN.

New Latin Reading Book; consisting of Short Sentences, Easy Narrations, and Descriptions, selected from Caesar's Gallic War; in Systematic Progression. With a Dictionary. Second Edition, revised. 12mo. 2s. 6d.

Allen's New Latin Delectus; being Sentences for Translation from Latin into English, and English into Latin; arranged in a systematic Progression. Fourth Edition, revised. 12mo. 4s. cloth.

The London Latin Grammar; including the Eton Syntax and Prosody in English, accompanied with Notes. Sixteenth Edition. 12mo. 1s. 6d.

Robson's Constructive Latin Exercises, for teaching the Elements of the Language on a System of Analysis and Synthesis; with Latin Reading Lessons and Copious Vocabularies. Third and Cheaper Edition, thoroughly revised. 12mo. 4s. 6d. cloth.

Robson's First Latin Reading Lessons. With Complete Vocabularies. Intended as an Introduction to Caesar. 12mo. 2s. 6d. cloth.

Smith's Tacitus; Germania, Agricola, and First Book of the Annals. With English Notes, original and selected, and Bötticher's remarks on the style of Tacitus. Edited by Dr. Wm. Smith, Editor of the Dictionary of Greek and Roman Antiquities, etc. Third Edition, greatly improved. 12mo. 5s.

Caesar. Civil War. Book I. *With English Notes for the* Use of Students preparing for the Cambridge School Examination. 12mo. 1s. 6d.

Terence. Andria. With English Notes, Summaries, and Life of Terence. By Newenham Travers, B.A., Assistant-Master in University College School. Fcap. 8vo. 3s. 6d.

HEBREW.

Hurwitz's Grammar of the Hebrew Language. Fourth Edition. 8vo. 13s. cloth. Or in Two Parts, sold separately:—Elements. 4s. 6d. cloth. Etymology and Syntax. 9s. cloth.

FRENCH.

Merlet's French Grammar. By P. F. Merlet, Professor of French in University College, London. New Edition. 12mo. 5s. 6d. bound. Or sold in Two Parts:—Pronunciation and Accidence, 3s. 6d.; Syntax, 3s. 6d. (Key, 3s. 6d.)

Merlet's Le Traducteur; Selections, Historical, Dramatic, and Miscellaneous, from the best French Writers, on a plan calculated to render reading and translation peculiarly serviceable in acquiring the French Language; accompanied by Explanatory Notes, a Selection of Idioms, etc. Fourteenth Edition. 12mo. 5s. 6d. bound.

Merlet's Exercises on French Composition. Consisting of Extracts from English Authors to be turned into French; with Notes indicating the Differences in Style between the two Languages. A List of Idioms, with Explanations, Mercantile Terms and Correspondence, Essays, etc. 12mo. 3s. 6d.

Merlet's French Synonymes, explained in Alphabetical Order. Copious Examples (from the "Dictionary of Difficulties"). 12mo. 2s. 6d.

Merlet's Aperçu de la Litterature Française. 12*mo.*

Merlet's Stories from French Writers; in French and English Interlinear (from Merlet's "Traducteur"). Second Edition. 12mo. 2s. cl.

Lombard De Luc's Classiques Français, à l'Usage de la Jeunesse Protestante; or, Selections from the best French Classical Works, preceded by Sketches of the Lives and Times of the Writers. 12mo. 3s. 6d. cloth.

ITALIAN.

Smith's First Italian Course; being a Practical and Easy Method of Learning the Elements of the Italian Language. Edited from the German of Filippi, after the method of Dr. Ahn. 12mo. 3s. 6d. cloth.

INTERLINEAR TRANSLATIONS.

Locke's System of Classical Instruction. Interlinear Translations. 1s. 6d. each.

Latin.

Phaedrus's Fables of Æsop.
Virgil's Æneid. Book I.
Parsing Lessons to Virgil.
Caesar's Invasion of Britain.

Greek.

Lucian's Dialogues. Selections.
Homer's Iliad. Book I.
Xenophon's Memorabilia. Book I.
Herodotus's Histories. Selections.

French.

Sismondi; the Battles of Cressy and Poictiers.

German.

Stories from German Writers.

Also, to accompany the Latin and Greek Series.

The London Latin Grammar. 12mo. 1s. 6d.
The London Greek Grammar. 12mo. 1s. 6d.

HISTORY, MYTHOLOGY, AND ANTIQUITIES.

Creasy's (Professor) History of England. With Illustrations. One Volume. Small 8vo. Uniform with Schmitz's "History of Rome," and Smith's "History of Greece." (Preparing).

Schmitz's History of Rome, from the Earliest Times to the Death of Commodus, A.D. 192. Ninth Edition. One Hundred Engravings. 12mo. 7s. 6d. cloth.

Smith's History of Greece, from the Earliest Times to the Roman Conquest. With Supplementary Chapters on the History of Literature and Art. New Edition. One Hundred Engravings on Wood. Large 12mo. 7s. 6d. cloth.

Smith's Dictionary of Greek and Roman Antiquities. By various Writers. Second Edition. Illustrated by Several Hundred Engravings on Wood. One thick volume, medium 8vo. £2 2s. cloth.

Smith's Smaller Dictionary of Greek and Roman Antiquities. Abridged from the larger Dictionary. New Edition. Crown 8vo. 7s. 6d. cloth.

Smith's Dictionary of Greek and Roman Biography and Mythology. By various Writers. Medium 8vo. Illustrated by numerous Engravings on Wood. Complete in Three Volumes. 8vo. £5 15s. 6d. cloth.

Smith's New Classical Dictionary of Biography, Mythology, and Geography. Partly based on the "Dictionary of Greek and Roman Biography and Mythology." Third Edition. 750 Illustrations. 8vo. 18s. cloth.

Smith's Smaller Classical Dictionary of Biography, Mythology, and Geography. Abridged from the larger Dictionary. Illustrated by 200 Engravings on Wood. New Edition. Crown 8vo. 7s. 6d. cloth.

Smith's Dictionary of Greek and Roman Geography. By various Writers. Illustrated with Woodcuts of Coins, Plans of Cities, etc. Two Volumes 8vo. £4. cloth.

Niebuhr's History of Rome. From the Earliest Times to the First Punic War. Fourth Edition. Translated by Bishop Thirlwall, Archdeacon Hare, Dr. Smith, and Dr. Schmitz. Three Vols. 8vo. £1 16s.

Niebuhr's Lectures on the History of Rome. From the Earliest Times to the First Punic War. Edited by Dr. Schmitz. Third Edition. 8vo. 8s.

Newman (F. W.) The Odes of Horace. Translated into Unrhymed Metres, with Introduction and Notes. Crown 8vo. 5s. cloth.

Newman (F. W.) The Iliad of Homer, Faithfully translated into Unrhymed Metre. 1 vol. crown 8vo. 6s. 6d. cloth.

Akerman's Numismatic Manual, or Guide to the Collection and Study of Greek, Roman, and English Coins. Many Engravings. 8vo. £1 1s.

Ramsay's (George) Principles of Psychology. 8vo. 10s. 6*d.*

PURE MATHEMATICS.

De Morgan's Elements of Arithmetic. Fifteenth Thousand. Royal 12mo. 5s. cloth.

De Morgan's Trigonometry and Double Algebra. Royal 12mo. 7s. 6d. cloth.

Ellenberger's Course of Arithmetic, as taught in the Pestalozzian School, Worksop. Post 8vo. 5s. cloth.

⁂ *The Answers to the Questions in this Volume are now ready, price* 1s. 6*d.*

Mason's First Book of Euclid. Explained to Beginners. Fcap. 8vo. 1s. 9d.

Reiner's Lessons on Form; or, An Introduction to Geometry, as given in a Pestalozzian School, Cheam, Surrey. 12mo. 3s. 6d.

Reiner's Lessons on Number, as given in a Pestalozzian School, Cheam, Surrey. Master's Manual, 5s. Scholar's Praxis, 2s.

Tables of Logarithms Common and Trigonometrical to Five Places. *Under the Superintendence of the Society for the Diffusion of Useful Knowledge.* Fcap. 8vo. 1s. 6d.

Four Figure Logarithms and Anti-Logarithms. On a Card. Price 1s.

Barlow's Tables of Squares, Cubes, Square Roots, Cube Roots, and Reciprocals of all Integer Numbers, up to 10,000. Royal 12mo. 8s.

MIXED MATHEMATICS.

Potter's Treatise on Mechanics, for Junior University Students. By Richard Potter, M.A., Professor of Natural Philosophy in University College, London. Third Edition. 8vo. 8s. 6d.

Potter's Treatise on Optics. Part I. All the requisite Propositions carried to First Approximations, with the construction of Optical Instruments, for Junior University Students. Second Edition. 8vo. 9s. 6d.

Potter's Treatise on Optics. Part II. The Higher Propositions, with their application to the more perfect forms of Instruments. 8vo. 12s. 6d.

Potter's Physical Optics; or, the Nature and Properties of Light. A Descriptive and Experimental Treatise. 100 Illustrations. 8vo. 6s. 6d.

Newth's Mathematical Examples. A graduated series of Elementary Examples, in Arithmetic, Algebra, Logarithms, Trigonometry, and Mechanics. Crown 8vo. With Answers. 8s. 6d. cloth.

Sold also in separate Parts, without Answers:—

Arithmetic, 2s. 6d.	Trigonometry and Logarithms, 2s. 6d.
Algebra, 2s. 6d.	Mechanics, 2s. 6d.

Newth's Elements of Mechanics, including Hydrostatics, with numerous Examples. By Samuel Newth, M.A., Fellow of University College, London. Second Edition. Large 12mo. 7s. 6d. cloth.

Newth's First Book of Natural Philosophy; or an Introduction to the Study of Statics, Dynamics, Hydrostatics, and Optics, with numerous Examples. 12mo. 3s. 6d. cloth.

NATURAL PHILOSOPHY, ASTRONOMY, Etc.

Lardner's Museum of Science and Art. Complete in 12 Single Volumes, 18s., ornamental boards; or 6 Double Ones, £1 1s., cl. lettered.

*** *Also, handsomely half-bound morocco, 6 volumes, £1 11s. 6d.*

Contents:—The Planets; are they inhabited Worlds? Weather Prognostics. Popular Fallacies in Questions of Physical Science. Latitudes and Longitudes. Lunar Influences. Meteoric Stones and Shooting Stars. Railway Accidents. Light. Common Things.—Air. Locomotion in the United States. Cometary Influences. Common Things.—Water. The Potter's Art. Common Things.—Fire. Locomotion and Transport, their Influence and Progress. The Moon. Common Things.—The Earth. The Electric Telegraph. Terrestrial Heat. The Sun. Earthquakes and Volcanoes. Barometer, Safety Lamp, and Whitworth's Micrometric Apparatus. Steam. The Steam Engine. The Eye. The Atmosphere. Time. Common Things.—Pumps. Common Things.—Spectacles—The Kaleidoscope. Clocks and Watches. Microscopic Drawing and Engraving. The Locomotive. Thermometer. New Planets.—Leverrier and Adams's Planet. Magnitude and Minuteness. Common Things.—The Almanack. Optical Images. How to Observe the Heavens. Common Things.—The Looking Glass. Stellar Universe. The Tides. Colour. Common Things.—Man. Magnifying Glasses. Instinct and Intelligence. The Solar Microscope. The Camera Lucida. The Magic Lantern. The Camera Obscura. The Microscope. The White Ants; their Manners and Habits. The Surface of the Earth, or First Notions of Geography. Science and Poetry. The Bee. Steam Navigation. Electro-Motive Power. Thunder, Lightning, and the Aurora Borealis. The Printing-Press. The Crust of the Earth. Comets. The Stereoscope. The Pre-Adamite Earth. Eclipses. Sound.

Lardner's Animal Physics, or the Body and its Functions familiarly Explained. 520 Illustrations. 1 vol., small 8vo. 12s. 6d. cloth.

Lardner's Animal Physiology for Schools (chiefly taken from the "Animal Physics"). 190 Illustrations. 12mo. 3s. 6d. cloth.

Lardner's Hand-Book of Mechanics.
357 Illustrations. 1 vol., small 8vo., 5s.

Lardner's Hand-Book of Hydrostatics, Pneumatics, and Heat. 292 Illustrations. 1 vol., small 8vo., 5s.

Lardner's Hand-Book of Optics.
290 Illustrations. 1 vol., small 8vo., 5s.

Lardner's Hand-Book of Electricity, Magnetism, and Acoustics. 395 Illustrations. 1 vol., small 8vo. 5s.

Lardner's Hand-Book of Astronomy and Meteorology, forming a companion work to the "Hand-Book of Natural Philosophy." 37 Plates, and upwards of 200 Illustrations on Wood. 2 vols., each 5s., cloth lettered.

Lardner's Natural Philosophy for Schools.
328 Illustrations. 1 vol., large 12mo., 3s. 6d. cloth.

Lardner's Chemistry for Schools.
170 Illustrations. 1 vol., large 12mo. 3s. 6d. cloth.

Pictorial Illustrations of Science and Art. Large Printed Sheets, each containing from 50 to 100 Engraved Figures.

Part I. 1s. 6d.
1. Mechanic Powers.
2. Machinery.
3. Watch and Clock Work.

Part II. 1s. 6d.
4. Elements of Machinery.
5. Motion and Force.
6. Steam Engine.

Part III. 1s. 6d.
7. Hydrostatics.
8. Hydraulics.
9. Pneumatics.

Lardner's Popular Geology. (From "The Museum of Science and Art.") 201 Illustrations. 2s. 6d.

Lardner's Common Things Explained. Containing: Air—Earth—Fire—Water—Time—The Almanack—Clocks and Watches—Spectacles—Colour—Kaleidoscope—Pumps—Man—The Eye—The Printing Press—The Potter's Art—Locomotion and Transport—The Surface of the Earth, or First Notions of Geography. (From "The Museum of Science and Art.") With 233 Illustrations. Complete, 5s., cloth lettered.

*** *Sold also in Two Series*, 2s. 6d. *each.*

Lardner's Popular Physics. Containing: Magnitude and Minuteness—Atmosphere—Thunder and Lightning—Terrestrial Heat—Meteoric Stones—Popular Fallacies—Weather Prognostics—Thermometer—Barometer—Safety Lamp—Whitworth's Micrometric Apparatus—Electro-Motive Power—Sound—Magic Lantern—Camera Obscura—Camera Lucida—Looking Glass—Stereoscope—Science and Poetry. (From "The Museum of Science and Art.") With 85 Illustrations. 2s. 6d. cloth lettered.

Lardner's Popular Astronomy. Containing: How to Observe the Heavens—Latitudes and Longitudes—The Earth—The Sun—The Moon—The Planets: are they Inhabited?—The New Planets—Leverrier and Adams's Planet—The Tides—Lunar Influences—and the Stellar Universe—Light—Comets—Cometary Influences—Eclipses—Terrestrial Rotation—Lunar Rotation—Astronomical Instruments. (From "The Museum of Science and Art.") 182 Illustrations. Complete, 4s. 6d. cloth lettered.

*** *Sold also in Two Series*, 2s. 6d. *and* 2s. *each.*

Lardner on the Microscope. (From "The Museum of Science and Art.") 1 vol. 147 Engravings. 2s.

Lardner on the Bee and White Ants; their Manners and Habits; with Illustrations of Animal Instinct and Intelligence. (From "The Museum of Science and Art.") 1 vol. 135 Illustrations. 2s., cloth lettered.

Lardner on Steam and its Uses; including the Steam Engine and Locomotive, and Steam Navigation. (From "The Museum of Science and Art.") 1 vol., with 89 Illustrations. 2s.

Lardner on the Electric Telegraph, Popularised. With 100 Illustrations. (From "The Museum of Science and Art.") 12mo., 250 pages. 2s., cloth lettered.

*** *The following Works from "Lardner's Museum of Science and Art," may also be had arranged as described, handsomely half bound morocco, cloth sides.*

Common Things. Two series in one vol.	7s. 6d.
Popular Astronomy. Two series in one vol.	7s. 0d.
Electric Telegraph, with Steam and its Uses. In one vol.	7s. 0d.
Microscope and Popular Physics. In one vol.	7s. 0d.
Popular Geology, and Bee and White Ants. In one vol.	7s. 6d.

Lardner on the Steam Engine, Steam Navigation, Roads, and Railways, Explained and Illustrated. Eighth Edition. With numerous Illustrations. 1 vol. large 12mo. 8s. 6d.

A Guide to the Stars for every Night in the Year. In Eight Planispheres. With an Introduction. 8vo. 5s., cloth.

*Minasi's Mechanical Diagrams. For the Use of Lec*turers and Schools. 15 Sheets of Diagrams, coloured, 15s., illustrating the following subjects: 1 and 2. Composition of Forces.—3. Equilibrium.—4 and 5. Levers.—6. Steelyard, Brady Balance, and Danish Balance.—7. Wheel and Axle.—8. Inclined Plane.—9, 10, 11. Pulleys.—12. Hunter's Screw.—13 and 14. Toothed Wheels.—15. Combination of the Mechanical Powers.

LOGIC.

De Morgan's Formal Logic; or, The Calculus of Inference, Necessary and Probable. 8vo. 6s. 6d.

Neil's Art of Reasoning: a Popular Exposition of the Principles of Logic, Inductive and Deductive; with an Introductory Outline of the History of Logic, and an Appendix on recent Logical Developments, with Notes. Crown 8vo. 4s. 6d., cloth.

ENGLISH COMPOSITION.

Neil's Elements of Rhetoric; a Manual of the Laws of Taste, including the Theory and Practice of Composition. Crown 8vo. 4s. 6d., cl.

DRAWING.

*Lineal Drawing Copies for the earliest Instruction. Com*prising upwards of 200 subjects on 24 sheets, mounted on 12 pieces of thick pasteboard, in a Portfolio. By the Author of "Drawing for Young Children." 5s. 6d.

Easy Drawing Copies for Elementary Instruction. Simple Outlines without Perspective. 67 subjects, in a Portfolio. By the Author of "Drawing for Young Children." 6s. 6d.

Sold also in Two Sets.

SET I. Twenty-six Subjects mounted on thick pasteboard, in a Portfolio. 3s. 6d.
SET II. Forty-one Subjects mounted on thick pasteboard, in a Portfolio. 3s. 6d.
The copies are sufficiently large and bold to be drawn from by forty or fifty children at the same time.

SINGING.

A Musical Gift from an Old Friend, containing Twenty-four New Songs for the Young. By W. E. HICKSON, author of the Moral Songs of "The Singing Master." 8vo. 2s. 6d.

The Singing Master. Containing First Lessons in Singing, and the Notation of Music; Rudiments of the Science of Harmony; The First Class Tune Book; The Second Class Tune Book; and the Hymn Tune Book. Sixth Edition. 8vo. 6s., cloth lettered.

Sold also in Five Parts, any of which may be had separately.

I.—*First Lessons in Singing and the Notation of Music.* Containing Nineteen Lessons in the Notation and Art of Reading Music, as adapted for the Instruction of Children, and especially for Class Teaching, with Sixteen Vocal Exercises, arranged as simple two-part harmonies. 8vo. 1s., sewed.

II.—*Rudiments of the Science of Harmony or Thorough* Bass. Containing a general view of the principles of Musical Composition, the Nature of Chords and Discords, mode of applying them, and an Explanation of Musical Terms connected with this branch of Science. 8vo. 1s., sewed.

III.—*The First Class Tune Book. A Selection of Thirty* Single and Pleasing Airs, arranged with suitable words for young children. 8vo. 1s., sewed.

IV.—*The Second Class Tune Book. A Selection of Vocal* Music adapted for youth of different ages, and arranged (with suitable words) as two or three-part harmonies. 8vo, 1s. 6d.

V.—*The Hymn Tune Book. A Selection of Seventy* popular Hymn and Psalm Tunes, arranged with a view of facilitating the progress of Children learning to sing in parts. 8vo. 1s. 6d.

⁂ The Vocal Exercises, Moral Songs, and Hymns, with the Music, may also be had, printed on Cards, price Twopence each Card, or Twenty-five for Three Shillings.

CHEMISTRY.

Gregory's Hand-Book of Chemistry. For the use of Students. By William Gregory, M.D., late Professor of Chemistry in the University of Edinburgh. Fourth Edition, revised and enlarged. Illustrated by Engravings on Wood. Complete in One Volume. Large 12mo. 18s. cloth.

*** *The Work may also be had in two Volumes, as under.*

* Inorganic Chemistry. Fourth Edition, revised and enlarged. 6s. 6d. cloth.

Organic Chemistry. Fourth Edition, very carefully revised, and greatly enlarged. 12s., cloth.

(Sold separately.)

Chemistry for Schools. By Dr. Lardner. 190 *Illustrations.* Large 12mo. 3s. 6d. cloth.

Liebig's Familiar Letters on Chemistry, in its Relations to Physiology, Dietetics, Agriculture, Commerce, and Political Economy. Fourth Edition, revised and enlarged, with additional Letters. Edited by Dr. Blyth. Small 8vo. 7s. 6d. cloth.

Liebig's Letters on Modern Agriculture. Small 8*vo.* 6*s.*

Liebig's Principles of Agricultural Chemistry; with Special Reference to the late Researches made in England. Small 8vo. 3s. 6d., cloth.

Liebig's Chemistry in its Applications to Agriculture and Physiology. Fourth Edition, revised. 8vo. 6s. 6d., cloth.

Liebig's Animal Chemistry; or, Chemistry in its Application to Physiology and Pathology. Third Edition. Part I. (the first half of the work). 8vo. 6s. 6d., cloth.

Liebig's Hand-Book of Organic Analysis; containing a detailed Account of the various Methods used in determining the Elementary Composition of Organic Substances. Illustrated by 85 Woodcuts. 12mo. 5s., cloth.

Bunsen's Gasometry; comprising the Leading Physical and Chemical Properties of Gases, together with the Methods of Gas Analysis. Fifty-nine Illustrations. 8vo. 8s. 6d., cloth.

Wöhler's Hand-Book of Inorganic Analysis; One Hundred and Twenty-two Examples, illustrating the most important processes for determining the Elementary composition of Mineral substances. Edited by Dr. A. W. Hofmann, Professor in the Royal College of Chemistry. Large 12mo.

Parnell on Dyeing and Calico Printing. (Reprinted from Parnell's "Applied Chemistry in Manufactures, Arts, and Domestic Economy, 1844.") With Illustrations. 8vo. 7s., cloth.

GENERAL LITERATURE.

De Morgan's Book of Almanacs. With an Index of Reference by which the Almanac may be found for every Year, whether in Old Style or New, from any Epoch, Ancient or Modern, up to A.D. 2000. With means of finding the Day of New or Full Moon, from B.C. 2000 to A.D. 2000. 5s., cloth lettered.

Guesses at Truth. By Two Brothers. New Edition. With an Index. Complete 1 vol. Small 8vo.

Rudall's Memoir of the Rev. James Crabb; late of Southampton. With Portrait. Large 12mo., 6s., cloth.

Herschell (R. H). The Jews; a brief Sketch of their Present State and Future Expectations. Fcap. 8vo. 1s. 6d., cloth.